FULFILLING THE PROMISE:
THE OCCOQUAN WATERSHED IN THE NEW MILLENNIUM

Report to the Fairfax County Board of Supervisors by the New Millennium Occoquan Watershed Task Force

January 27, 2003

FOREWORD

On July 26, 1982, the Board of Supervisors approved a downzoning of more than 41,000 acres in the Occoquan Watershed in Fairfax County and additional protections on about 64,500 adjacent acres. It was a process driven by citizens who cared about the County in which they live and who were willing to put in long hours to study the issues, to generate support, and to attend public hearings. During 2002, our Board commemorated the 20th Anniversary of this significant action that protected a source of one of our most vital natural resources -- our drinking water. As part of the celebration, the Board has honored those citizens and our County and regional agency staff who participated in the 1982 action and recognized those who are stewards of the Watershed today. We have published an informational brochure, and a video, *Occoquan*, has been created that tells the remarkable story.

The Board also established the New Millennium Occoquan Watershed Task Force of citizens, County staff, and regional agency representatives to look at the issues in the Watershed -- how they're the same, how they're different -- from 20 years ago. Their report, *Fulfilling the Promise - The Occoquan Watershed in the New Millennium,* presents recommendations to us about things that need to be done in order to maintain the high water quality in the Occoquan Reservoir and Watershed now and in the future.

We must remain vigilant. Twenty years ago our citizens rallied for an important cause. Because of their dedication, and with continuing community participation and County staff and agency expertise, we have ensured a protected source for safe drinking water. This is an important part of the quality of life we enjoy in Fairfax County today.

Katherine K. Hanley, Chairman
Fairfax County Board of Supervisors
January 27, 2003

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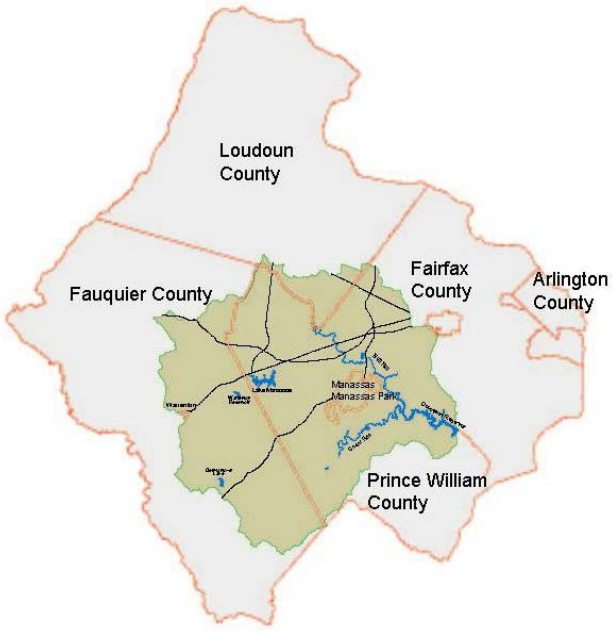
I. INTRODUCTION

On July 26, 1982, the Fairfax County Board of Supervisors voted to downzone nearly 41,000 acres in the Occoquan Watershed to protect the County's water supply. On March 18, 2002, the Board of Supervisors put in motion a year-long celebration in honor of the 20th anniversary of this land mark decision.

The Occoquan Watershed, which lies in the southwest portion of the County, consists of all the land, including tributary streams, draining into the Occoquan Reservoir, the Watershed's largest body of water. Seventeen percent of the Watershed, or roughly 64,500 acres, lies in the County. The rest of the 590 square-mile Watershed lies in parts of Prince William, Fauquier, and Loudoun counties. Figure 1 shows the Watershed in relation to the region. Figure 2 provides a detail of Fairfax County's portion of the Occoquan Watershed.

Figure 1. The Occoquan Watershed. (Source: NVRC)

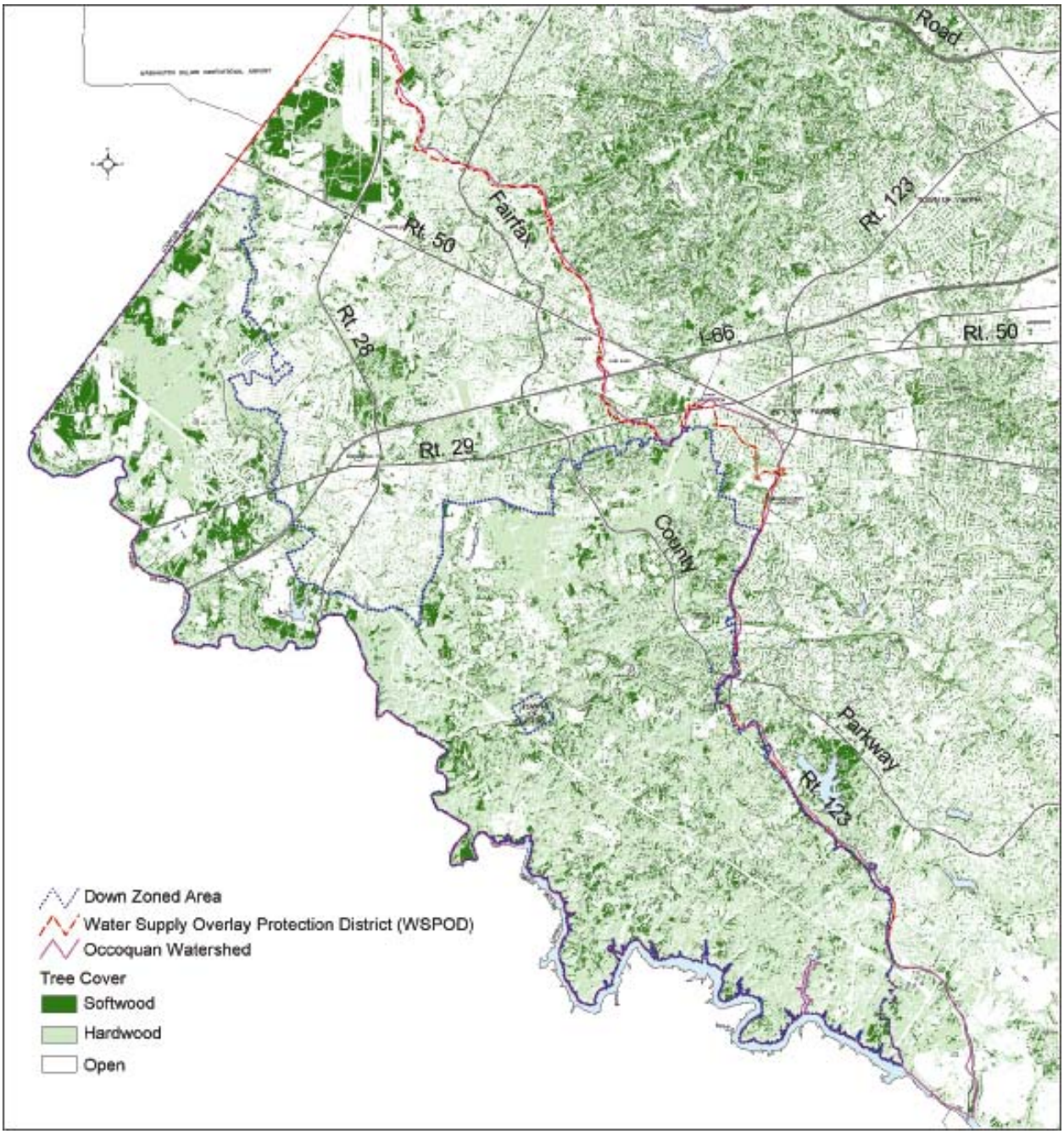


As part of the 20th anniversary celebration, the Board established a New Millennium Occoquan Watershed Task Force "to provide an assessment of issues facing the Fairfax County portion of the Occoquan Watershed, to examine gaps in programs not being carried out by local, State, and regional agencies, to define the role of volunteer organizations that have interests in the watershed, and to provide a vision for the future management of the watershed." In order to help the County fulfill this new vision, the Task Force was also directed to "develop management options for consideration at the County level, as well as options for consideration as part of a regional watershed planning effort."

New Challenges for a New Millennium

Since 1982, the population of Fairfax County's portion of the Watershed has grown significantly, and areas such as Centreville and Chantilly have become bustling centers for commerce and industry. According to U.S. Census data, the population of Centreville alone was 48,661 in 2000, which is almost double the 1990 population of 26,585. Over 48% of homes in Centreville have been built since 1990, while over 85% have been built since 1980.

Figure 2. Fairfax County's portion of the Occoquan Watershed, showing the 1982 downzoned area.



This growth, and its associated increase in impervious surface area, has created a host of new concerns for managing the Occoquan Watershed. For instance, the physical condition of the Watershed's tributaries has been identified as an emerging issue. Increased stormwater runoff from impervious surfaces flows into streams and creeks at a higher volume and velocity. The result is increased erosion of headwaters, blown-out banks, and down-cutting. Sensitive aquatic species can no longer live in many of the Watershed's streams – leaving a degraded aquatic ecosystem.

At the same time, there is growing recognition that the Watershed itself is more than just a source of water for the Reservoir. In addition to its role as an integral part of the drinking water system for approximately 1.2 million Northern Virginians, the Reservoir and the Watershed also provide the following benefits:

- The Reservoir protects water quality in the Potomac River and the Chesapeake Bay by trapping sediments and nutrients. According to the Occoquan Watershed Monitoring Lab (OWML), between 1983 and 1999, the Reservoir retained or converted 34% of total nitrogen, 56% of total phosphorus, and 83% of total sediment.

- The downzoned portion of the Watershed serves as a natural water treatment system, provides high quality ecological habitat, offers low-impact recreation, and supports low-density residential development as well as various public, semi-public, and agricultural uses.

- Areas of the Watershed outside the downzoned area support a wide range of important residential, commercial, and industrial uses.

- The Reservoir is a highly utilized regional recreational asset.

The challenge facing the County and region is how to best manage the Reservoir and the Watershed recognizing the primary benefit of the Reservoir as a reliable source of safe, clean drinking water and the importance of the Reservoir as an integrated ecological and hydrological system with multiple uses.

II. TASK FORCE PROCESS

The Task Force convened on September 13, 2002 and met through December 20, 2002. Appointed by the Chairman of the Board of Supervisors, the members of the Task Force represent a wide range of interests and expertise, including local and regional government, the scientific, environmental, and academic communities, wastewater and drinking water authorities, and community and citizen groups.

To help define the challenges and identify potential solutions, the Task Force solicited the input and advice of a number of expert individuals and organizations. Presentations from guest speakers and Task Force members helped shape the Task Force's agenda and provided focus to its discussions. The following is a list of major presentation topics:

- History of the Reservoir and Events Leading to the 1982 Downzoning:
  Presentation by Robert L. Howell, former Assistant County Attorney.

- Overview of Existing Institutional and Regulatory Framework:
  Presentation by the Northern Virginia Regional Commission on State and federal mandates, County and regional activities, and community/citizen watershed efforts.

- Drinking Water Protection:
  Presentations by the Fairfax County Water Authority and the Occoquan Watershed Monitoring Lab to assess the success of efforts to protect the Reservoir as a drinking water supply and to identify future challenges to the Reservoir.

- Health of Aquatic Habitats:
  Presentations by the Fairfax County Department of Public Works and Environmental Services and the Audubon Naturalist Society's Webb Sanctuary on the health of the Watershed's aquatic habitats.

- Land Use and Open Space:
  Presentations by the Fairfax County Department of Planning and Zoning, the Fairfax County Park Authority, and the Fairfax County Department of Public Works and Environmental Services on land use and open space issues, including an overview of existing Comprehensive Plan policies, relevant overlays (Chesapeake Bay Preservation Ordinance, Parks, Environmental Quality Corridors, etc.), infill and redevelopment policies, and the "by-right," Special Permit, and Special Exception review processes.

- Onsite Sewage Disposal:
  Presentation by the Fairfax County Health Department on health and pollution issues associated with on-site sewage treatment systems in the Occoquan Watershed.

- Citizen Involvement:
  Presentation by the Northern Virginia Soil and Water Conservation District on opportunities to strengthen environmental protection through citizen involvement and education.

A full listing of Task Force members is provided in Appendix A along with a listing of individuals who gave presentations to the Task Force.

III. HISTORY OF THE RESERVOIR AND EVENTS LEADING TO THE 1982 DOWNZONING

The story of the Occoquan Reservoir as a public water supply began in 1950, when the Alexandria Water Company constructed a 30-foot dam on the Occoquan River that impounded approximately 55 million gallons of water. In 1957, responding to the water supply needs of a growing population, a much larger dam, approximately 3,000 feet upstream from the lower dam, was constructed. In 1967, ownership of the Reservoir and associated treatment works passed to the newly-created Fairfax County Water Authority (FCWA), which continues to operate the system today. When initially constructed, the Occoquan Reservoir had an estimated storage capacity of 9.8 billion gallons, and a computed safe yield of about 50 million gallons per day (MGD). At the time of its completion, the Reservoir's 590 square mile watershed was principally of an undeveloped rural character - a condition that was felt to be likely to contribute to the long-term maintenance of a high level of quality of the impounded waters.

In 1959, after a period of unprecedented growth for Fairfax County and concern about the impact of this growth on natural resources such as the water supply, the Board of Supervisors adopted a new Comprehensive Plan as well as a Zoning Ordinance. The Plan limited development in the western two-thirds of Fairfax County to one house per every two acres of land. Many landowners fought the County's decision in court. The Virginia Supreme Court found the Board's action to be "discriminatory and exclusionary" and summarily rezoned the entire area to one house per acre of land. This was known as the "Carper Decision."

During the 1960s and the early 1970s, concern over the status of the Occoquan Reservoir and its viability as a water supply continued to grow. Eleven small, outdated wastewater treatment plants discharged high concentrations of nitrogen and phosphorus into the Reservoir. The high nutrient loads entering the Reservoir caused intense blooms of blue-green algae (cyanobacter), resulting in serious water quality problems. Those problems included frequent taste and odor episodes in finished drinking water, treatment problems associated with the presence of algal mats in the raw water, and oxygen loss and fish kills in the Reservoir.

Figure 3 shows a bloom of *microcystis* (a common species of cyanobacter) in the vicinity of Jacob's Rock in the summer of 1969. Figure 4 is a photograph of a bloom of the same species in the Bull Run arm of the Reservoir in the summer of 1973. Finally, Figure 5 illustrates a summer, 1973 *microcystis* bloom disrupted by the wake of a sampling boat near Jacob's Rock.

Figure 3. *Microcystis* bloom in the vicinity of Jacob's Rock in 1969. (Source: Metcalf & Eddy)

Figure 4. *Microcystis* bloom in the Bull Run arm of the Occoquan Reservoir in summer 1973. (Source: OWML)

Figure 5. Boat wake in *Microcystis* bloom near Jacob's Rock in summer 1973. (Source: OWML)

By the early 1970s, during low flow conditions, poorly treated wastewater from the eleven secondary treatment facilities in the Watershed represented a major part of the total inflow to the Reservoir. Figure 6 shows an aerial view of the confluence of Bull Run and Occoquan Creek in the fall of 1977, which was near the end of an extended period of drought. In the photograph, Bull Run is seen entering from the top right, and Occoquan Creek from the left. The main body of the Reservoir lies to the lower right. As seen from the exposed banks, the pool level of the Reservoir was substantially below normal, but what is most striking is the clear impact of the wastewater flows on the visual appearance of the waters of Bull Run. The high fraction of wastewater in the stream flow has imparted a grayish cast to the entire stream. In a further illustration of the impact of wastewater discharges, Virginia Tech researchers were able to isolate human enteric viruses in the Reservoir.[1]

Figure 6. Aerial view of the confluence of Bull Run and Occoquan Creek in fall 1977. (Source: OWML)

[1] Hoehn *et al.*, 1976.

The Virginia State Water Control Board (VSWCB) had been established in 1950 to oversee the State's environmental regulations and to grant permits associated with water supply. In 1968 and 1969, following an intensive study of water quality problems in the Occoquan Reservoir, the local governments joined with VSWCB in supporting a new, "Policy for Waste Treatment and Water Quality Management in the Occoquan Watershed."[2] Adopted in 1971, the "Occoquan Policy" mandated the replacement of outdated facilities with no more than three state-of-the-art advanced water reclamation plants and the creation of the independent Occoquan Watershed Monitoring Lab (OWML). A milestone in water quality management in the Commonwealth, the Policy included an implicit recognition that indirect re-use of reclaimed wastewater to supplement public water supply would become the operational norm in the Occoquan Watershed. It also recognized that extraordinary measures would be required to protect the public health in a situation where a water body was to be subjected to the competing uses of wastewater disposal and public water supply. In addressing this, the document not only specified the type of waste treatment practice to be adopted on a basin-wide scale, but it provided for an ongoing program of water quality surveillance to quantify the success of the water quality protection effort.

During the 1970s, the Northern Virginia Regional Park Authority (NVRPA) acquired 5,000 acres and created a series of contiguous parks along the Fairfax County shoreline of the Occoquan-Bull Run Stream Valley. This was in recognition that preserving a large buffer area around the Reservoir could contribute to protecting water quality. These parks continue to serve a public recreational use; act as a conservation area for forest, wetlands and wildlife; and help protect the shoreline of the Reservoir. Even before the NVRPA effort, the Fairfax County Park Authority began to acquire and operate parks in the Occoquan Watershed, eventually totaling several thousand acres. Twenty-six parks have been added since the downzoning in 1982.

In 1975, the Fairfax County Board of Supervisors adopted a revised Comprehensive Plan to replace the 1959 Plan. In the area that would be downzoned in 1982, the Plan generally recommended residential development densities that transitioned downward from Centreville, Chantilly, and Fairfax toward the southern and western boundaries of the County. The Plan map identified planned densities of 0.5-1 dwelling unit per acre (in places) transitioning downward to 0.1-0.2 dwelling units per acre and public park. The Comprehensive Plan text identified a density of one dwelling unit per five acres as the "primary development density" for much of the Watershed. However, the zoning of much of this area allowed residential development at densities up to one dwelling unit per acre.

In 1976, with funding provided by the U.S. EPA under Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), the Northern Virginia Planning District Commission and the Occoquan Watershed Monitoring Laboratory conducted a series of nonpoint source and urban runoff studies in the Occoquan and Four Mile Run watersheds. The project provided some of the first land use-specific data on the physical and chemical characteristics of pollutant loads originating from a variety of rural and urban land uses. The study results were useful to Fairfax County and other local governments throughout the region in their early attempts to integrate nonpoint source and urban runoff control into their stormwater management programs. From 1980 to 1982, building on the results of the 208 study, the Metropolitan Washington Council of Governments and the Occoquan Watershed Monitoring Laboratory conducted investigations into the design and performance of urban runoff best

[2] VSWCB, 1971. Fairfax County and local governments in the Watershed worked with the Northern Virginia Planning District Commission (now NVRC), the Metropolitan Washington Council of Governments (MWCOG), and the federal government pursuant to Section 208 of the Water Pollution Control Act.

management practices (BMPs) under the auspices of the U.S. EPA Nationwide Urban Runoff Program (NURP). The data from the Metropolitan Washington project formed the basis of the BMP efficiency values incorporated into the public facility manuals in a variety of regional jurisdictions.

In 1978, the Board of Supervisors adopted a new Zoning Ordinance. The new Ordinance applied to the entire County and repealed the earlier 1959 Ordinance. The 1978 action re-zoned all of the properties in the Occoquan Basin, as well as the rest of the County. This rezoning action was not an upzoning or downzoning but merely a replacement of the previous zoning district with the most comparable zoning district in the new Zoning Ordinance. Therefore, actual allowed zoning remained greater than the planned densities in much of the Occoquan Watershed.

In the same year, the Upper Occoquan Sewage Authority (UOSA) Water Reclamation Facility (WRF) was placed in service and became the nation's largest and most successful project for the indirect reuse of reclaimed water to supplement a public surface water supply. Although there were also nonpoint sources of pollution in the Reservoir, the UOSA facility improved the condition of the Reservoir by eliminating most point source pollution discharge problems in the Watershed. The plant serves the western portions of the counties of Fairfax and Prince William that are within the Occoquan Watershed and the cities of Manassas and Manassas Park.

Fairfax County recognized that continued growth and development in the Watershed could counter the nutrient reductions in point source pollution made by the initiation of the UOSA operations. As a result, in 1979, the Fairfax County Board of Supervisors, as part of the Annual Plan Review, adopted a Plan Amendment (79-CW-4E) that directed staff to complete an Occoquan Basin Study focusing on nonpoint source contamination. The Plan Amendment stated the following:

> *Recent studies have demonstrated that nonpoint sources of pollution contribute to deteriorating water quality in the Occoquan Reservoir. This diffuse source of land use related pollution has taken new significance with the completion of the UOSA advanced wastewater treatment plant. The 1978 opening of UOSA mitigates a major point source of pollution in the Occoquan. Therefore, water quality problems in the future will be influenced substantially by pollutant loads associated with stormwater runoff. At this time the County does not have a comprehensive policy approach for handling the problems of nonpoint pollution. However, now that the magnitude of the problem is understood, such an approach is necessary. In 1979, the County planning staff will undertake a study of the relationship of land use to water quality in the Occoquan. This study will include a re-evaluation of land use designations currently adopted in this watershed. In addition the applicability of technical strategies such as best management practices for nonpoint pollution control will be assessed. Products of this study may include recommendations for further revisions to the plan and/or revisions to the Public Facilities Manual. (Also Item 79-CW-4E quoted in Memo to Fairfax County Board of Supervisors as amended, January 28, 1980)*

On January 14, 1980, the Board of Supervisors officially authorized the Occoquan Basin Study and appointed "The Citizens Task Force on the Occoquan Basin." Its members included representatives from each of the then eight magisterial districts and from the following organizations: Dulles Airport Noise Impact Study Committee Task Force; Environmental Quality Advisory Council (EQAC); Fairfax Bar Association; Fairfax County Chamber of Commerce; Fairfax County Federation of Citizens Associations; League of Women Voters of the Fairfax

Area; Northern Virginia Board of Realtors; Northern Virginia Building Industry Association (NVBIA); and the Tree Commission. The principal water quality concern was determined to be accelerated eutrophication caused by nonpoint source pollution. The work program included the following tasks:

- Determine the effects of development as projected by the adopted plan on water quality in the Occoquan Watershed;
- Determine the effects of alternative plan options for the Occoquan Basin that would modify the adopted plan to conform to land use and noise policies;
- Dulles Airport aircraft noise impact area delineation;
- Assure water quality protection in the Occoquan Basin;
- Realize economic development benefits from land with existing and planned access to major arterials, such as I-66, without causing detrimental effects on existing and planned residential environments; and,
- Identify and test effective and practical implementation strategies to protect the water quality in the Fairfax County portion of the Occoquan Basin.

In 1979 and 1980 the Board of Supervisors also authorized a staff study to run concurrently with the work of the Task Force to develop several "scenarios" for future development of the Occoquan Watershed and to explore the feasibility and effectiveness of stormwater management best management practices (BMPs).

On March 8, 1982, the Task Force's report (Occoquan Basin Study) was transmitted to the Board of Supervisors and the public. The Report recommended that the best way to protect the Watershed from the impact of stormwater runoff would be a land use zoning density of one residence per five acres in about two-thirds of the Watershed, while stringent stormwater BMPs would be necessary in the remaining urbanized areas. In May and June, Comprehensive Plan amendments went forward to the Planning Commission and the Board incorporating recommendations of the Task Force and suggesting land use changes for the Comprehensive Plan. At the same time, public information meetings were held on the Task Force report findings. The Plan was amended on June 15, 1982.

On July 26, 1982, the Board of Supervisors also took several zoning actions consistent with the recommendations of the Task Force report, including the downzoning of nearly 41,000 acres of land in the Watershed to the Residential-Conservation (R-C) District, or one dwelling unit per five acres.[3] In this area, sanitary sewer service is generally not provided and public water

[3] List of Actions included:

- Amending the Zoning Ordinance to reduce the minimum yard requirements in the R-C District and allowing cluster by Special Exception in the R-C District;
- Amending the Zoning Ordinance to establish the Water Supply Protection Overlay District (WSPOD);
- Amending the Zoning Ordinance to revise the existing Airport Noise Impact Overlay District;
- Adopting amendments to Sec. 1-20A of the Public Facilities Manual to strengthen BMP requirements;
- Establishing a Technical Committee consisting of County staff, professional engineers, and planners from the private sector to study and furnish recommendations on changes to the Public Facilities Manual to provide for rural subdivision standards in areas such as those proposed for R-C cluster zoning.
- Establishing a new permit category to allow Board of Zoning Appeals (BZA) consideration of minimum yard modifications and setting a special low fee for affected home-owners;
- RZ 82-W-051 – Water Supply Protection Overlay District - placed on all lands within Fairfax County's portion the Occoquan watershed, as advertised (over 63,000 acres);
- RZ 82-W-052 – Applied the Airport Noise Impact Overlay District to lands near Dulles Airport (over 17,000 acres);

supply services are not extensive. In addition to the downzoning, the Board created a Water Supply Protection Overlay District (WSPOD), implementing strict stormwater controls on approximately 63,000 acres.[4] The wisdom of this action was confirmed as a necessary measure when the State Water Control Board announced later in the year that the phosphorus and nitrogen levels in the Occoquan Reservoir made it the second most polluted lake in Virginia.

A consortium of 39 real estate developers sued the County. *Amicae Curiae* (Friends of the Court) in support of the County during the Circuit Court trial included: the Fairfax County Federation of Citizens Associations, League of Women Voters of the Fairfax Area, Northern Virginia Soil and Water Conservation District, Fairfax County Water Authority, Virginia Association of Counties (VACo), Loudoun County, and the Environmental Defense Fund. In one of the longest court cases at the time in the County, the Board's 1982 downzoning action was upheld in a landmark 1985 Circuit Court decision. The decision preserved the five-acre zoning in the downzoned portion of the Watershed, helping to protect the water quality of Occoquan Reservoir. It also reinforced the ability of local governments in Virginia to implement their comprehensive plans and enabled jurisdictions to effectively plan for the future.

- RZ 82-W-053 – Rezoned to I-3 parcels in the areas near Dulles Airport that were most heavily affected by aircraft-related noise (over 1,600 acres); and,
- RZ 82-W-054 – Rezoned to the R-C District lands in the southern and western portions of the Water Supply Protection Overlay District, as advertised (nearly 41,000 acres).

[4] The Occoquan Basin Study referenced a figure of 64,497 acres and applied the figure in water quality modeling efforts. A figure of 64,500 acres was incorporated into the Plan language that was adopted a few weeks prior to the downzoning. The actual acreage applied to the Water Supply Protection Overlay District (RZ 82-W-051) was 63,118 acres.

IV. WHO AND WHAT PROTECTS THE OCCOQUAN: AN OVERVIEW OF THE EXISTING INSTITUTIONAL AND REGULATORY FRAMEWORK

As outlined in the previous section of this report, the original strategy for protecting water quality in the Reservoir consisted of a multi-tiered approach in cooperation with the federal government, the State, adjacent counties, and regional bodies, and was based on the premise that both point and nonpoint sources of pollution contributed to water quality degradation. Primary point source pollution control strategies included:

1) the 1971 Occoquan Policy;
2) shutting down the eleven small treatment plants; and,
3) operation of the regional Upper Occoquan Sewage Authority Water Reclamation Facility beginning in 1978.

Nonpoint source pollution control strategies included:

1) the 1982 Occoquan Basin Study;
2) the downzoning of nearly 41,000 acres of the Watershed to serve as a natural water treatment system;
3) preservation of large areas of open and green space through the Fairfax County Park Authority and the Northern Virginia Regional Park Authority; and,
4) development of stormwater BMP requirements.

Today, these efforts have been expanded and supplemented through new technologies, the implementation and enforcement of County-wide water quality protection measures, and the active engagement of citizens and community organizations. New federal and State mandates, such as the Virginia Chesapeake Bay Preservation Act of 1988, have required the establishment of new programs and have taken water quality management in new directions. As a result, management of the Occoquan Reservoir and Watershed is ever changing and those responsible for its protection are constantly rising to new challenges. The following is an overview of current institutions involved in managing the Occoquan Reservoir, County-wide regulations and programs that are applicable to the Occoquan Watershed, and new mandates that will help to shape management in the future.

A. Direct Reservoir Management

The Fairfax County Water Authority (FCWA), the Occoquan Watershed Monitoring Lab (OWML), and the Upper Occoquan Sewage Authority (UOSA) are the primary agencies responsible for direct management of the Reservoir. The Northern Virginia Regional Park Authority and the Virginia Department of Environmental Quality (through its regulatory authority) also have responsibility for some aspect of direct Reservoir management.

1. Fairfax County Water Authority

The Fairfax County Water Authority employs a number of strategies to ensure the continued health and reliability of the Reservoir. FCWA monitors chemical, physical, and biological water quality throughout the Reservoir. Based on the monitoring results, FCWA may use different treatment strategies during the water treatment process or

directly at the Reservoir, including aeration to prevent bottom waters from reaching anoxic levels or the application of an algaecide to control the levels of blue-green algae present in warmer months. The FCWA's Board of Director's Water Quality Committee develops and reviews policies related to protecting source waters and maintains a grant program that places emphasis on educational and watershed protection activities.

In response to the evolution of more stringent drinking water regulations, the FCWA has undertaken the construction of a new treatment facility on a site formerly occupied by the Lorton Correctional Facility. When completed, the Fred P. Griffith Water Treatment Plant will represent the state-of-the-art in water treatment, and will enable the Authority to remove from service some of the original facilities that date back to the 1950s.

2. Occoquan Watershed Monitoring Lab

The Occoquan Watershed Monitoring Lab employs a full-time staff to monitor for a host of organic and chemical pollutants, including but not limited to COD, TN, MBAS, TSS, TP, turbidity, and a number of SOCs.[5] OWML maintains a network of seven rain gaging stations in the Watershed, nine stream gaging and sampling stations, and nine Reservoir sampling stations. The stream sampling stations are configured with equipment and instrumentation to allow the automatic retrieval and storage of samples during all storm events. The analytical results of such samples, combined with streamflow data, allow OWML to make accurate calculations of loads of various chemical constituents.

3. Upper Occoquan Sewage Authority

The Upper Occoquan Sewage Authority's management of the Reservoir consists primarily of providing a high quality inflow stream into Bull Run, contributing to the overall quality of the Reservoir and the increased reliability of the Reservoir's capacity. Today, the average inflow into the Occoquan Reservoir is 370 million gallons per day, of which UOSA contributes approximately 25 million gallons per day (about five percent). The treated wastewater is generally cleaner than water entering through the Reservoir's tributaries, and therefore actually improves water quality in the Reservoir.

B. Watershed Management

Many Fairfax County Government agencies as well as many organizations within the County are involved in promoting water quality and habitat protection in the Occoquan Watershed. Some of the agencies and organizations involved are the Department of Public Works and Environmental Services (DPWES), the Department of Planning and Zoning, the Fairfax County Health Department, the Northern Virginia Soil and Water Conservation District (NVSWCD), Fairfax County Office of the Virginia Cooperative Extension, the Fairfax County Park Authority, the Northern Virginia Regional Park Authority, the Environmental Quality Advisory Council (EQAC), the Tree Commission, the County Attorney's Office, and the Northern Virginia Regional Commission (NVRC). These agencies and organizations are responsible for implementing both Occoquan-specific and County-wide regulations and programs designed to protect water quality and habitats, or in the case of EQAC and the

[5] Chemical Oxygen Demand (COD), Total Nitrogen (TN), Methylene-blue-active substances (MBAS), Total Suspended Solids (TSS), Total Phosphorus (TP), Synthetic Organic Compounds (SOCs).

Tree Commission, for advising the County's Board of Supervisors on environmental issues facing the County, including those related to the Occoquan Watershed.

To better focus the County's stormwater and watershed planning efforts, the Stormwater Planning Division (SWPD) of the DPWES was created in 2000. Among the SWPD's primary objectives are to develop comprehensive stormwater management plans and to review current County-wide policies affecting the ecosystem and stormwater management issues. The SWPD is working to develop a framework to address the overall environmental goals and objectives of the County and to ensure a link among the planning phase, design regulations and standards, construction practices, and maintenance efforts. Representatives of the SWPD, Maintenance and Stormwater Management Division (MSMD), and several other agencies within DPWES have formed the Stormwater Management Core Team (STW) to provide broad leadership on stormwater issues.

The County's water quality protection efforts are extensively documented in the EQAC's *Annual Report on the Environment*, the County's 2001 *Stream Protection Strategy Baseline Study*, and in the *Annual VPDES MS4 Report for Fairfax County to the Virginia Department of Environmental Quality*. The latter document is a requirement of the County's permit, issued by the Virginia Department of Environmental Quality, to discharge stormwater into State waters through its municipal separate storm sewer system (MS4). This is a particularly important regulatory program in that it requires the County to develop and implement a Stormwater Management Plan to eliminate the introduction of pollution into the storm sewer system to the Maximum Extent Practicable (MEP).

The following is a summary of major County-wide regulations, programs, and initiatives that directly benefit the Occoquan Watershed and Reservoir. They are organized into four key functions: (1) data gathering and monitoring; (2) planning for the future; (3) regulation; and (4) public involvement and outreach. Most of these regulations, programs, and initiatives are discussed in greater depth later in this report.

1. Data Gathering and Monitoring

Obtaining a solid basis for decision-making is critical to making policy and regulatory decisions regarding the Occoquan Watershed. Among the County's oldest and most comprehensive monitoring programs, the Department of Health's Division of Environmental Health has conducted a stream water quality program since 1969. Currently, 85 sites within 25 of the County's 30 watersheds are sampled twice a month. The primary objective of the program is to monitor the water quality of County streams and assess the potential human health risk associated with fecal coliform bacteria. This information is also used to locate pollution sources and to initiate corrective action.

While the Health Department's program focuses on water quality testing, the County launched a Stream Protection Strategy (SPS) program in 1998 to assess the physical stability and ecological integrity of major streams and tributaries within the 30 watersheds in the County. Field sampling has been conducted annually since 1999 and 25% of original sites are monitored each year. The results from the original baseline assessment completed in 2000 were used to identify, rank, and prioritize County streams. Broad management categories and strategies were subsequently developed for future restoration and/or preservation efforts on a sub-watershed basis. The SPS Baseline Study was published in January 2001 and is available on the County's website.

The Northern Virginia Soil and Water Conservation District's Volunteer Stream Monitoring Program supplements the SPS program and provides other services to the environmental community in Fairfax County. The volunteer monitoring program has active sites monitored by trained monitors throughout the County. In 2001, 35 monitoring sites were active during the winter, 30 sites were active during spring, 61 sites were active during summer, and 36 sites were active during fall.

Recognizing the increasing role of the DPWES Stormwater Planning Division in watershed management and monitoring, the SWPD is currently preparing a comprehensive water quality monitoring plan that will incorporate the Health Department's stream monitoring program by June 2003. Combining the stream monitoring activities of the Health Department with those of the SWPD will place all County stream monitoring activities into one agency. This will result in more efficient coordination of County and volunteer water quality data collection efforts and allow for more informed decision making that will be required in the development of watershed management plans.

2. Planning for the Future

One of the County's most important planning tools is the Comprehensive Plan, which consists of a County-wide Policy Plan and four Area Plans. The Policy Plan provides guidance on environmentally sensitive areas, including Environmental Quality Corridors (EQCs). The Area III Plan (and, to a much lesser extent the Area II Plan) provides guidance on development of land in the area encompassing the Occoquan R-C District and a portion of the Occoquan Watershed.

In a major step forward in planning for water quality and habitats, Fairfax County is moving aggressively to develop and implement watershed management plans for each of the County's 30 watersheds. As an extension of the SPS process noted above, watershed management plans will allow the County and affected stakeholders to plan for the needs of specific watersheds based upon unique features and challenges. The first phase of the process will consist of a detailed stream physical assessment of the entire County over an anticipated one-year time frame. The second phase will be the development of detailed watershed management plans for selected watersheds sequenced over the next five to seven years.

Another important planning effort affecting the Occoquan Watershed was the "Infill and Residential Development Study" requested by the Board of Supervisors in May 1999. During the last decade, development patterns in the County and the Occoquan Watershed have been increasingly characterized by infill development. While the Study was County-wide in scope, many of the stormwater management and erosion and sediment control elements of the Study have direct relevance to the Occoquan Watershed. The Study reviewed the effectiveness of current policies and practices regarding erosion control and storm drainage with the multiple goals of minimizing impacts of stormwater runoff from a proposed development on downstream properties, limiting the impacts of stormwater management facilities on neighborhoods, ensuring that developers are accountable for impacts from their developments, and upgrading existing inadequate facilities. Study recommendations were accepted by the Board of Supervisors at a public hearing on January 22, 2001.

The Northern Virginia Regional Park Authority (NVRPA) and the Fairfax County Park Authority (FCPA) actively plan to minimize the impact of park development and use on the land, environment, and community. A significant part of the NVRPA and FCPA's missions is to protect and preserve significant and sensitive natural resources. The NVRPA and FCPA acknowledge the Occoquan Reservoir as an essential regional resource and have tailored land management and stewardship strategies to protect the Reservoir. Examples of those strategies include the FCPA's preservation of an extensive Stream Valley Park network along the tributaries of the Occoquan and the NVRPA's maintenance of forested buffers along nearly the entirety of the Bull Run and the Occoquan River shorelines in Fairfax County.

Regional planning and coordination with other Watershed localities is achieved through the Occoquan Basin Nonpoint Pollution Management Program. The goal of the program is to help localities maintain acceptable water quality in the Reservoir through control of nonpoint source pollutant loadings. The Northern Virginia Regional Commission maintains the Occoquan Basin Computer Model, which during the early 1980s served as the basis for downzoning the Fairfax County portion of the Watershed to protect drinking water from pollution caused by urban development. Every five years, NVRC performs an assessment of changes in land uses in the Watershed to update the model and to help localities determine whether additional land management efforts need to be undertaken.

3. Regulation

In addition to the County's Zoning Ordinance, specifically the R-C District and WSPOD requirements, the County's major water quality regulatory tools include the Erosion and Sediment Control Ordinance, the Chesapeake Bay Preservation Ordinance, and the Public Facilities Manual.

The Erosion and Sediment Control Ordinance (Chapter 104 of the Fairfax County Code) requires actions to reduce sediment deposition from construction sites and requires adequate outfalls for stormwater discharges to protect downstream properties and waters from upstream impacts.

The Chesapeake Bay Preservation Ordinance (Chapter 118 of the Fairfax County Code), or CBPO, was adopted by the Board in 1993 and was designed to protect certain areas along tributary streams designated Resource Protection Areas (RPAs). Areas outside the RPA are designated Resource Management Areas (RMAs), where BMPs are required to reduce nutrient loadings resulting from new development and redevelopment. The CBPO is enforced through the development review and inspection process. The NVSWCD develops conservation plans for agricultural lands under provisions of the CBPO as well as for Agricultural and Forestal Districts in the County.

Recent efforts by the County should result in significant strengthening of the CBPO. A project to "field identify" perennial streams in the County was initiated in early 2001 in response to Board direction, partly as a result of an EQAC resolution regarding the mapping and protection of all perennial streams under the Chesapeake Bay Preservation Ordinance. The reason behind the recommendation was that the CBPO protected only tributary streams defined as a "blue line" on a U.S.G.S. quadrangle map. However, these maps were not meant to be used for such purposes and generally underestimated the true extent of perennial streams. The effort took on added

importance when the State Chesapeake Bay Preservation Area Designation and Management Regulations were amended to mandate that all "water bodies with perennial flow" be protected by an RPA buffer area. A work group consisting of representatives from several Fairfax County agencies has evaluated the issues concerning the mapping of perennial streams and has recommended a protocol to accomplish their identification. The entire County is expected to have all headwater streams identified and mapped over a two-year time frame – by the end of 2003.

The Public Facilities Manual provides guidelines governing the design of public facilities including storm drainage, sewage disposal, erosion and sediment control, vegetation preservation and planting, and BMPs. Although the original suite of BMPs to meet the requirements of the WSPOD and later the CBPO were limited to dry ponds, wet ponds, and infiltration trenches (where soils allowed), the County has begun to expand its options and to encourage the use of design techniques aimed at reducing impervious surface cover. The incorporation of "rain gardens" (also known as bioretention or biofiltration facilities) is one example.

4. Public Involvement and Outreach

Regulation is not the only way the County implements policy. The activities of numerous organizations contribute to public awareness of watershed protection issues in Fairfax County. Programs range from public education addressing pollutants and other detriments to water quality to volunteer services in monitoring and clean up efforts. An example was the Adopt-A-Stream program initiated in June 1989 by the Health Department to promote citizen awareness of the potential hazards of recreational usage of streams and to educate citizens in identifying and reporting possible pollution problems. Participants in the program ranged from individuals, Scout groups, civic associations, and school science classes. Unfortunately, this program has not been active since 1999 due to budget constraints.

The NVSWD also conducts special programs at schools, make presentations at environmental conferences, sponsor tours, and publish a newsletter. In addition they partner with other groups in the County government, homeowners associations, County parks, and private environmental organizations.

Public involvement and outreach programs are discussed in more detail in Section VI.

C. New Regulatory Challenges

New federal and State regulations have the potential to greatly affect how the Reservoir is managed. This was demonstrated by the sweeping changes ushered in by the Occoquan Policy in 1971 and the RPA requirements of the Chesapeake Bay Preservation Act in 1988 (formalized by State regulations in 1989). More recently, Fairfax County was required to obtain a Virginia Pollutant Discharge Elimination System (VPDES) permit from the Department of Environmental Quality to discharge stormwater through its municipal separate storm sewer system (MS4). Issued to the County on January 24, 1997 (State Water Control Law Permit No. VA0088587), the permit has required the County to develop a Stormwater Management Program pursuant to State and federal guidelines.

The Total Maximum Daily Load (TMDL) requirements of the Clean Water Act represent a relatively new regulatory effort that will almost certainly affect the way that the Reservoir is managed. In its basic form, a TMDL is a pollution budget established for streams that violate State water standards. In other words, a TMDL is the greatest amount of a pollutant that a waterbody can receive without violating applicable water quality standards. Background, point source, and nonpoint source loadings are considered.

TMDLs have already been developed for Accotink Creek and Four Mile Run. According to the Department of Environmental Quality's most recent list of water bodies that violate State standards (commonly known as the 303(d) report), Occoquan Watershed TMDLs will be required for Popes Head Creek (benthics[6]), Bull Run (benthics), and Occoquan Bay (pH and PCBs). In addition, the 2002 303(d) report lists the Occoquan Reservoir itself as impaired for dissolved oxygen (DO). While DEQ has proposed that the impairment is naturally occurring and therefore does not require the development of a TMDL, an intensive study will need to be conducted to demonstrate that the impairment is non-anthropogenic. At present, OWML, FCWA, UOSA, and NVRC are working with the State to determine the best approach to the study.

The implication for the County is that the greater degree of control at the federal and State level, the less control there is at the local level. As a result, it is very important that the County be active in the development and planning of TMDLs.

Virginia's Tributary Strategies process will also present new challenges to Fairfax County. The multi-jurisdictional 2000 Chesapeake Bay Agreement, signed by Governor James Gilmore in June 2000, commits Virginia to a host of water quality and habitat-related commitments and goals. Among the most important of these is a commitment to remove the Chesapeake Bay from the U.S. EPA's list of impaired waters by the year 2010. Such an effort will require significant additional reductions in both nutrient and sediment loads to the Chesapeake Bay. While the 2000 Chesapeake Bay Agreement is non-regulatory, failure to meet its water quality commitments could result in the imposition of a TMDL, which is regulatory in nature, on the entire Chesapeake Bay watershed.

[6] Benthics, short for benthic macroinvertebrates, refers to organisms living in, or on, bottom substrates in aquatic ecosystems. Waters may be considered impaired if monitoring indicates that benthic macroinvertebrate communities have been degraded.

V. RESERVOIR AND WATERSHED PROTECTION

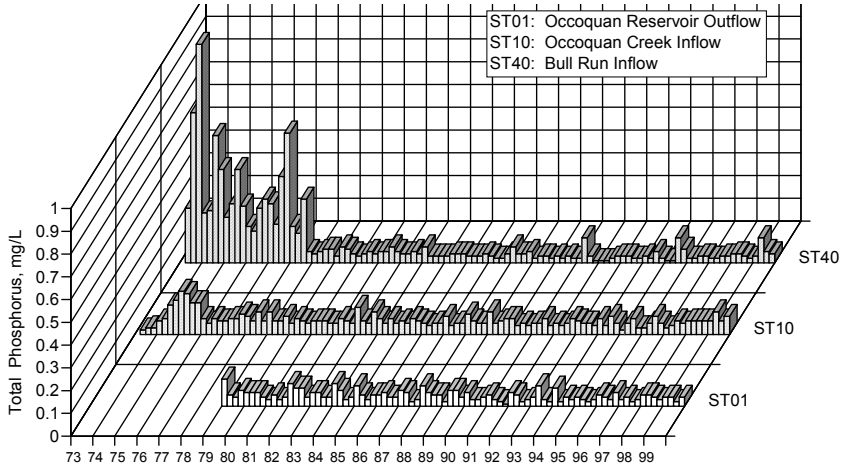
A. The Reservoir: Have We Successfully Protected Our Drinking Water Supply?

To answer the question, "Have we successfully protected our drinking water supply?," the Task Force examined two separate but interrelated issues -- Reservoir water quality and Reservoir storage capacity.

1. Reservoir Water Quality Trends

When placed in service in the summer of 1978, the UOSA Water Reclamation Facility (WRF) resulted in immediate improvements in Reservoir water quality. Because of the large fraction of Watershed nutrient loads that had previously originated from older treatment plants, the high performance of the UOSA WRF provided dramatic evidence of the reduction of nutrient concentrations in the Reservoir. Figure 7 shows a time series of seasonal average concentrations of total phosphorus at the points of entry of Bull Run (ST40) and Occoquan Creek (ST10) into the Reservoir, and the outflow point (ST01) from the Reservoir. As seen from the figure, prior to UOSA start-up in 1978, it was not uncommon for phosphorus concentrations in Bull Run to exceed 0.2 mg/L and, at times, to approach 1 mg/L. In order to place these values in context, the results of a nutrient criteria technical advisory group to the Virginia Department of Environmental Quality (DEQ) concluded that phosphorus concentrations should not exceed 0.1 mg/L in streams, and 0.05 mg/L in lakes and reservoirs.[7] Sawyer (1947) concluded in studies of Lake Mendota in Madison, Wisconsin, that algal growth could not be effectively limited unless phosphorus concentrations were maintained below 0.02 mg/L.

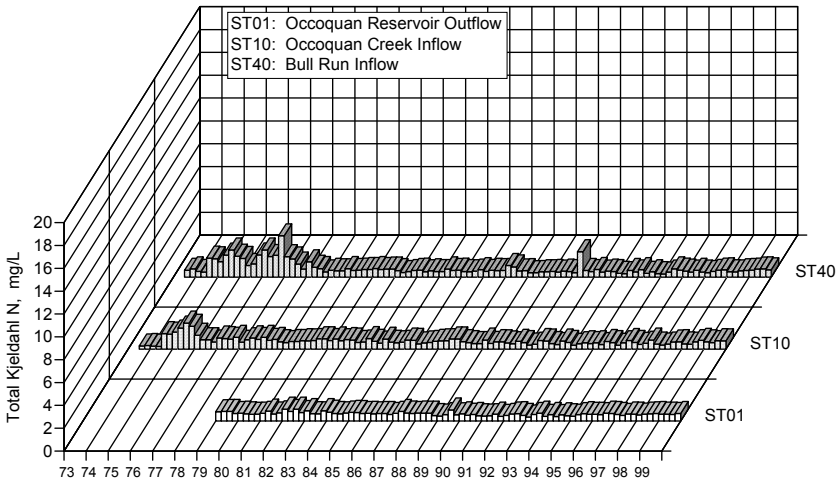
Figure 7. Seasonal time series of total phosphorus in Occoquan Reservoir inflows and outflows, 1973 – 1999. (Source: OWML).



[7] Virginia DEQ, 1987.

Immediately following UOSA start-up, average phosphorus concentrations in the waters of Bull Run declined to values near 0.05 mg/L. Storm events may dramatically impact the concentrations (and the delivered loads of phosphorus from nonpoint sources), but the seasonal average concentrations in the figure are a good indicator of ambient water quality. Figure 8 shows a seasonal time series of total Kjeldahl nitrogen (TKN), which is the sum of ammonia and organic nitrogen forms, at the inflow and outflow points of the Reservoir. A similar trend to that previously described for phosphorus may be observed. Although domestic wastewaters contain large amounts of TKN, UOSA operates to convert them to nitrate (an oxidized form), which serves a useful function in further limiting the amount of phosphorus that may be recycled from the Reservoir sediments.

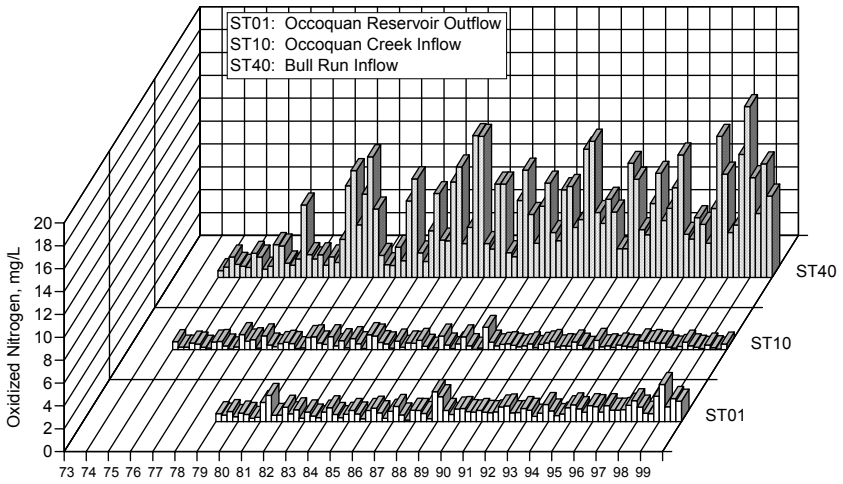
Figure 8. Seasonal time series of TKN in Occoquan Reservoir inflows and outflows, 1973 – 1999. (Source: OWML)



UOSA discharges most of its nitrogen as nitrate, and as a result the concentrations of nitrate in Bull Run have tended to rise since the start-up of the WRF, as shown in the seasonal time series in Figure 9. The most interesting feature of the data, however, is that the elevated concentrations of nitrate are not carried through to the lower Reservoir. By comparing the Bull Run inflow data to the observed concentrations at the outflow point (Station ST01), it is clear that some removal or conversion of nitrate is taking place in the main body of the Reservoir. Research conducted by OWML has conclusively shown that this *in situ* loss of nitrate provides an important water quality benefit in that it serves to maintain oxidizing conditions in the Reservoir bottom waters, and prevents the release of stored phosphorus from the deposited sediments.

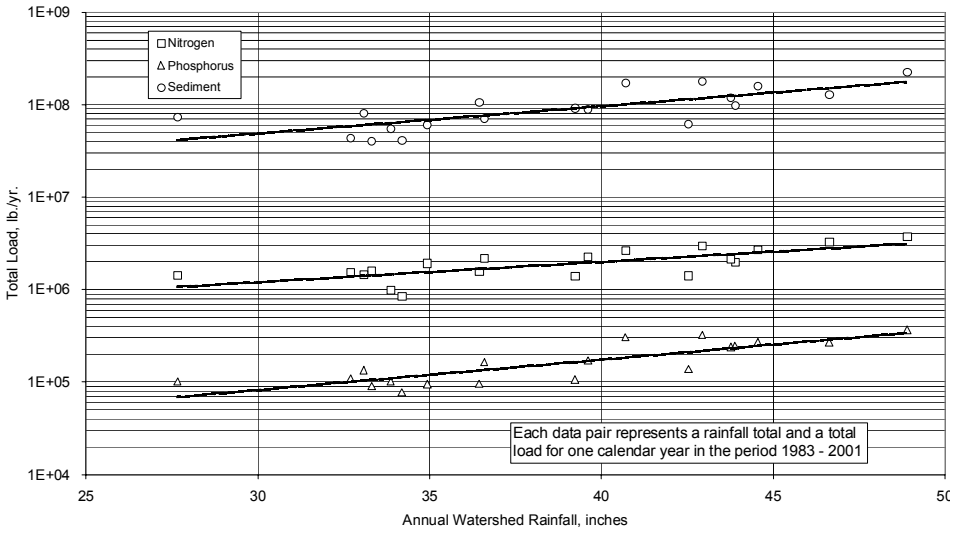
While important from the standpoint of limiting the algae growth potential of the Reservoir, the *in situ* nitrate removal is also of great interest with regard to the 40 percent nutrient reduction goal that is a centerpiece of the effort to restore the Chesapeake Bay. In-Reservoir nitrogen removal has been shown to have a dramatic impact on the net transport of nitrogen to the Potomac Estuary from the Occoquan Watershed.

Figure 9. Seasonal time series of oxidized nitrogen in Occoquan Reservoir inflows and outflows, 1973 – 1999. (Source: OWML)



Because OWML conducts a comprehensive stream gaging and sampling program throughout the Watershed, it is possible to construct an accurate budget of annual pollutant loads, and to evaluate the impacts of those loads on the enrichment state of the Reservoir. Figure 10 shows a plot of the annual loads of total nitrogen (TN), total phosphorus (TP), and total suspended sediment (TSS) entering the Reservoir from all sources as a function of Watershed rainfall for the period from 1983 through 2001. In the figure, each data pair represents a rainfall total for one of the years in the period and the total constituent load for that year. Because the trend lines for each constituent exhibit such a clear positive relationship to the annual rainfall, it may be reasonably concluded that rainfall, and the resulting nonpoint source runoff, are the principal driving forces in the delivery of key pollutants from the Watershed in the post-UOSA years.

Figure 10. Annual runoff loads of nutrients and sediment in the Occoquan Watershed as a function of rainfall, 1983 – 2001. (Source: OWML)



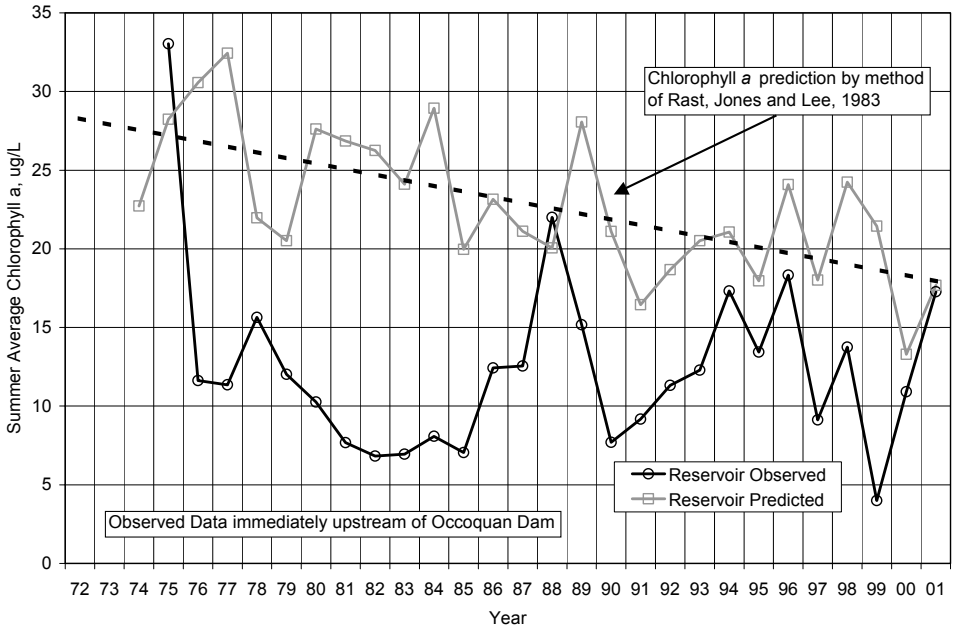
It is equally clear that the management actions taken over the last quarter century have had a positive impact in reducing the level of enrichment. However, the size of the Watershed, the range of human activity it supports, and nearly 50 years of nutrient accumulation in Reservoir sediments mean that nutrient supplies will always be sufficient to maintain the Reservoir in a nutrient-enriched, or eutrophic, state.

Since 1978, water quality in the Reservoir has remained stable, or has exhibited slight improvements. In addition to the impact of the UOSA WRF, the water quality improvements may also be attributed in part to the establishment of a range of regional nonpoint source pollution control measures. In addition to the 1982 downzoning in Fairfax County, these include the implementation of watershed-wide stormwater BMP requirements in developed areas, and educational programs that have resulted in voluntary adoption of improved conservation practices in remaining agricultural areas. It is important to note that these improvements have taken place in a period when the Watershed population nearly tripled.

A widely used measure of trophic state (level of nutrient enrichment) in lakes and reservoirs is the concentration of chlorophyll *a*, which is one of the photosynthesis pigments present in all algae. The U.S. EPA, in the National Eutrophication Survey (1974), proposed using 12 ug/L chlorophyll *a* as the lower boundary of eutrophic conditions in lakes and reservoirs. Rast, Jones, and Lee (1978) developed a widely used empirical relationship between phosphorus loading to lakes and reservoirs and the resulting amount of chlorophyll *a* to be expected during the summer algal growing season. Because of the extensive Watershed nutrient loading database developed by OWML, the method developed by Rast, Jones, and Lee may be applied for the period from 1974 through 2001. Figure 11 shows the annual summer average chlorophyll *a* to be anticipated as a result of the monitored phosphorus loads to the Reservoir during the period. The actual observed chlorophyll *a* values during the summer growing seasons are also plotted in the figure. A linear relationship fitted to the predicted data shows a substantial downward trend, which is consistent with other trophic state analyses by OWML (1997).

The observed summer average data, however, are more difficult to interpret. Clearly, the observed values also exhibit a generally downward trend, but they are generally lower than the model predictions. This may be explained by the continuing use of copper sulfate as an algaecide targeted towards blue-green species. In recent years, the values of the predicted and observed data have been more comparable. In the 1990s, lower copper sulfate doses were applied to the Reservoir; the summer average values of chlorophyll *a* were observed to drop into the mesotrophic range in 1990, 1992, 1997, and 1999. While these observations do not yet indicate an overall return to a less enriched condition, they are part of a general trend of improvement.

Figure 11. Predicted and observed trend in summer average Chlorophyll *a* in the Occoquan Reservoir. (Source: OWML)



2. Reservoir Storage Capacity

When the Occoquan Reservoir was originally impounded in 1957, the total available storage was estimated at 9.8 billion gallons (BG) at a pool elevation of 120 feet above mean sea level (ft. msl). While the original estimate was made using the standard of practice at the time, it was based on manual planimetric measurements from topographic maps with a 20-foot contour interval. As a result, these measurements are not thought to be directly comparable to measurements using current state-of-the-art field techniques. In addition, the overall accuracy of such estimates may be affected by the fact that the computations fail to capture the effects of any terrain features between contour lines. This effect may also have been exacerbated by the fact that the total analysis crossed only four contour lines: 60, 80, 100 and 120 ft. msl.

In the 1970s, OWML cooperated with the United State Geological Survey (USGS) to develop estimates of sediment accumulation rates from *in situ* measurements in the Reservoir. Unfortunately, the USGS protocol was not successful in producing useful sedimentation rate estimates, and the project was terminated.

Extrapolation of the original (1957) storage capacity curve to a pool level of 122 ft. msl indicated that a total storage of 11.2 BG, providing an increase of 1.4 BG, could be obtained by raising the elevation of the principal spillway by two feet. The estimated increase in storage is more reliable than the original volume estimate because it may be roughly approximated by multiplying the pool area by the two foot elevation increment. In 1982, the FCWA completed an increase in the principal spillway elevation in order to take advantage of the increased storage volume.

In 1989, a Reservoir survey was conducted by a contractor engaged by UOSA. Because the original purpose of the 1989 survey was to provide information on

horizontal water velocities at increments of Reservoir length, only 30 cross sections were established along a Reservoir length of over 10 miles. Nevertheless, the 1989 data provided an opportunity to perform a rough estimate of storage volume. Using the available data, and a mathematical curve fitting technique, OWML computed a storage volume of 7.75 BG at 122 ft. msl. Because this value differed so much from the original estimate, it prompted some immediate concern over (1) the accuracy of the estimate from the 1989 data, (2) the initial accuracy of the pre-impoundment volume determination, and (3) the magnitude of storage loss to sediment deposition.

Plans were initiated to perform a more detailed hydrographic survey because of the uncertainty introduced by the 1989 estimate. In order to do this, OWML reviewed the techniques used in computing volumes of spoil material removed in harbor and navigable waterway dredging operations and found that recent advances in electronic survey techniques had made possible detailed direct mapping of the Reservoir bottom at relatively low cost.

In 1995, the FCWA provided funding to OWML for a hydrographic survey using differential global positioning system (GPS) measurements to position survey points in the horizontal plane, and ultrasonic sounding to provide bottom point elevations. These technologies made possible a survey that had horizontal positioning accuracy of less than one meter, and depth measurement accuracy of less than 0.1 foot. Most importantly, the new system made it possible to map the elevation of many more points on the Reservoir bottom (over 10,000), giving an accuracy that was unattainable with manual field sounding methods. The FCWA also funded an update of the 1995 survey in 2000, providing an opportunity to assess changes in storage capacity over a time interval of five years.

The latest survey in 2000 resulted in a full pool (122 ft. msl) Reservoir storage of 8.32 BG, which is 0.2 BG less than the value from the 1995 survey. While the latest data indicate a small storage loss, it is not yet clear how much of this difference is due to actual sediment deposition or to the precision of the survey method. OWML is planning to conduct another survey in 2005, the data from which will make it possible to perform a more accurate assessment of trends.

In evaluating the map-based and field-based estimates of storage capacity, the following conclusions seem appropriate:

- The map-based estimates of storage capacity from 1957 do not appear to be comparable to field measurement-based survey results using either manual or more recent electronic methods. As a result, the original estimates do not provide useful comparisons for estimates of trends in storage change.
- Anecdotal evidence provided by OWML seems to support the proposition that the long, narrow shape of the Occoquan Reservoir results in periodic scouring of deposited material during extreme high flow events, thereby increasing available storage.
- Information on storage trends, and the precision of the survey methods currently employed will be available in 2005.
- The current full pool storage of the Reservoir may be taken as 8.3 BG.

3. Future Concerns

With increasing population and development pressure, traditional nonpoint sources of pollution (nutrients and sediments) will continue to have the potential to threaten Reservoir water quality. In addition, other contaminants associated with human activity will increasingly have the potential to threaten water quality. Two recent initiatives will help the region to plan for these possibilities:

- The Fairfax County Water Authority, UOSA, OWML, and UOSA member jurisdictions to include Fairfax County have launched a long-term study of water quality issues referred to as the Global Strategy Initiative or "Global Study." This initiative is a multi-phased study that intends to address water quality issues other than nutrients and conventional parameters, which have been the focus of water quality management for the past 30 years. The study will address the unique nature of industrial discharges to UOSA and their effect on the Reservoir. An additional focus will be human health related issues in the water treatment industry such as newly recognized pathogens and endocrine disrupting chemicals.

- The Water Authority has completed a Source Water Assessment as required under the federal Safe Drinking Water Act. This assessment consists of a GIS inventory of potential sources of contamination within a defined area upstream of the Reservoir, including discharges, hazardous materials sites, land use, and other relevant data.

Loss of Reservoir storage capacity, primarily due to sediment loads from the Watershed, is also a major long-term concern. While this threat has been recognized for many years, only recently has technology provided a means of performing detailed hydrographic surveys in a cost-effective manner. The first of these surveys was performed by OWML with funding from the FCWA in 1995. While a follow-up survey in 2000 indicated a 0.2 BG loss of storage capacity from 1995, the information is not of sufficient detail to establish a trend line. Another follow-up survey scheduled for 2005 should allow for a more accurate assessment of trends.

RESERVOIR
FINDINGS AND RECOMMENDATIONS

Findings

1.	The establishment of the Upper Occoquan Sewage Authority Water Reclamation Facility (WRF) in 1978 ameliorated extremely poor water quality conditions in the 1960s and 1970s and has largely eliminated wastewater, at least in terms of nutrient enrichment, as a threat to Reservoir water quality.
2.	Since 1978, according to monitoring data from the Occoquan Watershed Monitoring Lab, water quality in the Reservoir has remained stable or has slightly improved. This can be attributed to region-wide nonpoint source (NPS) pollution controls, including Fairfax County's 1982 downzoning and regional implementation of best management practices (BMPs). The accomplishment is particularly notable given that the Watershed's population nearly tripled during the period of 1978 to 2000 and highlights the wisdom behind the County's approach to Reservoir management.

RESERVOIR FINDINGS AND RECOMMENDATIONS

3.	The Reservoir remains eutrophic (nutrient enriched), which can be attributed in part to naturally occurring conditions. The degree to which reductions from anthropogenic nutrient sources are needed for a healthy ecosystem is unclear; however, any additional reductions will need to come from nonpoint sources. According to OWML, two-thirds of nitrogen and 95% of phosphorus inputs to the Reservoir are from nonpoint sources.
4.	Decisions concerning the need for additional pollutant reductions will likely be driven by State and federal clean water mandates and standards.
5.	The Task Force is concerned about the impact of sediment loads on the Reservoir's long-term storage capacity. A hydrographic survey scheduled to be performed by OWML in 2005, building on surveys conducted in 1995 and 2000, should allow for trends analysis and provide information to the County on how storage loss from sediment inputs will affect drinking water supplies.
6.	As development continues, non-traditional pollutants (those other than nutrients and sediments) have the potential to threaten water quality. The interagency Global Strategy Initiative will address emerging human health related issues in the water treatment industry such as pathogens and endocrine disrupting chemicals. The Fairfax County Water Authority's newly completed Source Water Assessment assesses potential sources of contamination including hazardous material sites, land use, and other relevant data. The data can be used to help set priorities for source water protection and identification of water protection strategies.

Recommendations

1.	The Task Force strongly endorses existing programs and policies aimed at maintaining acceptable levels of water quality in the Reservoir. The County should oppose any effort to weaken regional policies, particularly the State's Occoquan Policy governing wastewater treatment.
2.	The County should strive to reduce nutrient and sediment contributions to the Reservoir above and beyond those being achieved through existing policies and ordinances.
3.	The County should continue to be an active participant in State and federal regulatory and/or policy initiatives that might result in requirements for additional nutrient and sediment reductions in order to ensure that reduction strategies are based on sound policy and science.
4.	The Task Force strongly endorses efforts such as the Global Strategy Initiative to predict and mitigate new pollutants of concern.
5.	The Task Force encourages the continued sharing and coordination of information among UOSA, OWML, and FCWA and County staff to ensure that Reservoir water quality concerns are appropriately addressed.

B. The Watershed

1. Health of the Watershed's Streams and Aquatic Ecosystems

The streams that feed the Occoquan Reservoir and the valleys they run through harbor valuable and complex aquatic and terrestrial ecosystems. These systems provide important ecological functions such as reducing nutrient loads, mitigating pollution, and providing wildlife habitat. Their role as stopovers and nesting habitat for migratory songbirds gives our stream valleys an international connection. They offer tremendous recreational and educational assets for nearby communities. Their ecological health can also be an early warning sign of problems that will affect downstream systems, including the Occoquan Reservoir.

a) Assessment of Stream Ecological Health

An assessment of the ecological health of Occoquan Watershed streams is critical to any understanding of the long-term trends affecting water quality. Fairfax County is fortunate to have a strong set of baseline data on the ecological integrity of its streams. The *Fairfax County Stream Protection Strategy Baseline Study*, released in 2001, provides a detailed assessment of biological communities and aquatic and riparian habitats throughout the County, including its portion of the Occoquan Watershed.

The study is the culmination of a two-year effort that included an extensive field assessment of County streams, using the U.S. Environmental Protection Agency's Rapid Bioassessment Protocols, 2nd Edition, and the Incised Channel Evolution Model. Additional data continue to be collected by volunteer stream monitors from the Northern Virginia Soil and Water Conservation District and the Audubon Naturalist Society. Monitoring efforts involved sampling benthic macroinvertebrate and fish communities, as well as assessing the surrounding habitat. Both the Stream Protection Strategy (SPS) and volunteer results provide an important indication of the health of tributary streams.

Benthic macroinvertebrates are stream-bottom dwelling organisms that lack a backbone and are visible to the naked eye. They include organisms such as aquatic insects, crustaceans, mollusks, leeches, and worms. They form permanent communities in streams that can be measured and tracked over time. Because they vary in their sensitivity to water quality, they make excellent indicators of water quality.

The presence of good numbers of sensitive benthic macroinvertebrates generally indicates good water quality, while a preponderance of tolerant forms indicates water quality problems. Fish serve a similar function as indicator organisms, although they are far more mobile than benthic macroinvertebrates and can temporarily escape some water quality problems.

In-stream and riparian habitats also provide important clues about water quality. Factors such as bank stability, stream morphology, forested buffers, canopy cover, channel flow, streamside vegetation, and sediment can indicate water

quality problems. Characteristics that indicate a healthy stream with good water quality include:

- Strong numbers and taxonomic diversity of benthic macroinvertebrates and fish, with sensitive forms well represented.
- For Piedmont streams, a regular sequence of pools and riffles, a large proportion of riffle area composed of cobble and gravel that are free of sediment, deep pools with cover for fish, and a water flow that fills most of the available channel most of the year.
- A meandering, natural channel that shows no evidence of artificial channelization or reinforcement.
- Well-vegetated stream banks that show little evidence of erosion and slope gently to the waterline.
- A tree canopy that mostly or entirely covers the stream channel.
- A wide forested buffer along the stream where human activities have had minimal impact.

b) Threats to the Ecological Integrity of Streams

The ecological integrity of streams in the Occoquan Watershed and elsewhere is vulnerable to the impact of human activities, particularly those that change land uses. As noted previously, the County has made tremendous progress in eliminating the impact of point source pollution on the Occoquan Reservoir and has aggressively pursued the control of nonpoint source pollution. The challenges now are to continue to prevent nonpoint source pollution from reversing the progress made in the last few decades and to ensure that streams in the Watershed will be better protected from the impacts of stormwater runoff.

As a watershed is developed, the land's ability to slow down and absorb precipitation is altered. Conversion of forests, fields, and meadows that absorb precipitation to roads, rooftops, parking lots, and other impervious surfaces that shed it causes increased runoff volume and velocity. The consequences to the ecological integrity of our streams include the following:

- Stream channels must change to accommodate increased volumes and velocity of flow from stormwater runoff. This involves downcutting into the streambed, which destroys habitat for benthic macroinvertebrates and other organisms.
- Steep, unstable streambanks are created as streams cut into their beds. As these banks erode, silt and sediment are released into the water column. As the sediment settles, it fills spaces under and between rocks and gravel where benthic organisms live.
- Collapsing banks carry away streamside vegetation, depriving the stream of shade that moderates water temperatures. Warmer temperatures reduce the amount of dissolved oxygen water holds. The loss of this vegetation also eliminates an important source of organic detritus that represents a major food source for aquatic ecosystems.
- Stormwater runoff can carry with it fertilizer, pesticides, herbicides, motor oil and other automotive fluids, sediment, fallout from air pollution, and other pollutants from roads and other impervious surfaces.

- Stormwater running off heated impervious surfaces causes direct thermal shock to aquatic organisms as well as reductions to dissolved oxygen levels.

An article from the Center for Watershed Protection (CWP)[8] suggests that watersheds with impervious surface cover of 10 to 15% will show clear signs of degradation, while watersheds with impervious surface cover greater than 25% typically do not support a diverse stream community. For particularly sensitive aquatic organisms, impacts can occur at even lower levels of imperviousness than 10%. These impacts occur even with the use of current performance-based stormwater best management practices. A more recent review of research on the impact of imperviousness and mitigation by stormwater management facilities by the CWP suggests that the original conclusions are still valid, although stormwater ponds might have some mitigating effect at impervious cover ranges of 5 to 20%. The most recent detailed accounting of impervious surface cover, conducted by the Northern Virginia Regional Commission in 2000, estimates total Watershed imperviousness to be between 9 and 12%. Many of the Occoquan's subwatersheds are far in excess of 25% imperviousness.

Consistent with the CWP's research, in the downzoned areas of the watershed, impervious surface levels are generally low and overall stream health rankings, as identified in the SPS report, are high. Six of eight watersheds are rated as "excellent." However, outside the downzoned area only five of eleven streams are rated "excellent" or "good." Three are rated as "fair," while three are rated as "poor." This indicates a strong link between water quality and land use.

[8] Schueler, T. 1994a. "The Importance of Imperviousness". *Watershed Protection Techniques* 2(4): 100-111).

Figure 12. Site condition ratings for Occoquan subwatersheds.

SPS Sites with Subsheds Located Primarily Within the Downzoned Area of the Occoquan Watershed

Watershed	Stream Name and Site Code	Composite	Environmental Variables				
		Site Condition Rating	Index of Biotic Integrity	Habitat Score	Fish Taxa Richness	Current Percent Impervious Surfaces	Projected Percent Impervious Surfaces[1]
Bull Run	Bull Run Tributary (BLBT01)	Excellent	Excellent	Fair	High	0.8	5
Johnny Moore Creek	Johnny Moore Creek 1 (JMJM01)	Excellent	Good	Good	High	2.6	6
	Johnny Moore Creek 2 (JMJM02)	Excellent	Poor	Good	High	2.4	5
Popes Head Creek	Castle Creek (PHCC01)	Excellent	Fair	Good	High	3.9	5
Old Mill Branch	Old Mill Branch (OMOM01)	Excellent	Excellent	Fair	Low	3.5	5
Wolf Run	Wolf Run 1 (WRWR01)	Fair	Excellent	Fair	Very Low	3.3	5
	Wolf Run 2 (WRWR02)	Excellent	Excellent	Good	Moderate	3.9	5
Ryans Dam	Ryans Dam Unnamed Trib (RDRT01)	Excellent	Excellent	Fair	Moderate	3.3	5
Sandy Run	Sandy Run 1 (SASA01)	Excellent	Good	Good	High	6.1	6
	Sandy Run 2 (SASA02)	Excellent	Good	Good	Moderate	4.4	5
	Sandy Run Unnamed Trib. (SASA02)	Fair	Good	Fair	Very Low	1	8
Occoquan	Elk Horn Run (OCEH01)	Excellent	Excellent	Excellent	Low	3.6	14

SPS Sites Within the Downzoned Area, But With Some Headwaters Outside the Downzoned Area

Popes Head Creek	Piney Branch 1 (PHPI01)	Fair	Poor	Fair	High	12.8	14
	Popes Head Creek 1 (PHPH01)	Good	Poor	Fair	High	13.1	20
	Piney Branch 2 (PHPI02)	Fair	Poor	Poor	High	8.3	9
	Popes Head Creek 2 (PHPH02)	Fair	Fair	Poor	Moderate	11.4	14
	Castle Creek (PHCC01)	Excellent	Fair	Good	High	3.9	5
	Popes Head Creek 3 (PHPH03)	Good	Poor	Fair	Moderate	8	10

SPS Sites with Subsheds Located Primarily Outside the Downzoned Area of the Occoquan Watershed

Cub Run	Cain Branch (CUCB01)	Fair	Fair	Poor	Moderate	16.8	51
	Cub Run (CUCU02)	Good	Good	Fair	Low	8.4	43
	Flatlick Branch 1 (CUFB01)	Poor	Poor	Poor	High	21.2	39
	Flatlick Branch 2 (CUFB02)	Poor	Fair	Fair	Low	22.6	49
	Cub Run 2 (CUCU03)	Good	Poor	Good	Moderate	10.4	46
	Big Rocky Run 1 (CUBR01)	Good	Fair	Excellent	High	27.4	47
	Big Rocky Run 2 (CUBR02)	Fair	Fair	Fair	Moderate	27.7	44
	Elklick Run (CUER02)	Fair	Fair	Fair	Very Low	2.2	5
	Cub Run 3 (CUCU04)	Poor	Fair	Very Poor	Moderate	12.2	32
	Cub Run 4 (CUCU05)	Good	Fair	Fair	Moderate	12	31
Little Rocky Run	Little Rocky Run 1 (LRLR01)	Fair	Poor	Good	High	14.6	27
	Little Rocky Run 2 (LRLR02)	Good	Fair	Good	High	17.7	32
	Little Rocky Run 3 (LRLR03)	Fair	Poor	Good	Moderate	19.1	33

[1] The method that was used in the SPS baseline study, to determine the projected percent of impervious surface, was not accurate enough to provide precise projections.

c) Future Concerns

While streams within the downzoned areas of the watershed show generally good water quality, many Occoquan Watershed tributaries extend beyond these areas into much more densely developed communities with higher levels of impervious surface. In almost all cases, streams that rank only "fair" or "poor" are also the streams in areas with the highest impervious surface cover. While other factors can have an influence, impervious surface levels in a watershed have been widely demonstrated to be good predictors of water quality and ecological health of streams.

The watersheds of many of the streams outside the downzoned area that currently rate as "good" will probably experience significant increases in impervious surface as additional development occurs. The Stream Protection Strategy Baseline Study report provides projections of potential impervious surface conditions in watershed areas upstream of data collection points (see Figure 12). Care should be taken, however, in applying these projections; the method that was used to project impervious surface was not refined enough to produce precise results. As development proceeds in these areas, though, it is likely that there will be considerable stream degradation in the future unless additional stormwater management practices are employed over and beyond those currently employed by the County. In addition to increased volumes and velocities of stormwater runoff associated with increased impervious cover, land disturbance during construction results in increased silt loads on the streams. This impact varies based on the diligence of the contractors and abilities of the construction inspectors to enforce compliance in order to prevent silt-laden runoff from reaching the streams.

Both the Virginia Department of Transportation and the Metropolitan Washington Airports Authority (MWAA) have land-disturbing projects in the headwaters of the Occoquan Watershed. Both of these agencies are outside the regulatory authority of Fairfax County, although MWAA projects in Fairfax County must be consistent with the County's Chesapeake Bay Preservation Ordinance. Soil erosion incidents associated with land disturbance for MWAA and VDOT projects result in the conveyance of silt laden runoff into the streams. These incidents are generally not immediately apparent to the County until complaints are raised by citizens or inspectors notice discolored streams and track the source to these projects. This has occurred in the past and resulted in the County working with those parties to resolve the problems. While the cumulative effect of these incidents on the Reservoir may not be substantial, they can have devastating effects on ecosystems in headwaters streams. Also, the incidents result in citizen perceptions that projects within the County are not being appropriately implemented, monitored, and enforced.

While the Task Force's concern is primarily with areas outside the downzoned portion of the Watershed, there are also some concerns for areas in the downzoned portion. Tree removal for by-right development of single lots will result in increased runoff velocities and volumes into streams. Also, construction at these sites can release sediment pulses into the streams. Stream crossings used by all terrain vehicles, which are especially common along utility easements, are additional sources of silt and degrade stream bank stability.

While numbers for such crossings are not available, anecdotal evidence suggests that this concern merits further investigation. In addition, general turf management is a concern due to the potential for improperly application and overuse of fertilizers and pesticides to negatively impact water quality.

Finally, horses are a common sight in downzoned portion of the Occoquan Watershed and are an important part of the Watershed's culture. While recognized as a beneficial use in County policy and planning documents, care must be taken to ensure that horse operations do not have adverse effects on nearby streams. These can include: excess nutrients from improperly managed manure, fertilizers, and pesticides used in pasture maintenance; riparian vegetation loss; bank erosion; and excess siltation and pollution from animals allowed access to streams. The U.S. Department of Agriculture recommends one horse per three acres; however, County regulations permit up to three horses per acre. Maintaining good water quality with such high densities requires rigorous management by horse farm operators. To this end, and pursuant to the County's Chesapeake Bay Preservation Ordinance, the Northern Virginia Soil and Water Conservation District works within residents to develop conservation plans to manage horse operations in an environmentally sound manner.

d) Tools for Reducing Impacts on Stream Ecosystems

Fairfax County has available a variety of tools to reduce current and potential impacts on streams both inside and outside the downzoned areas. These include:

- Land Use Management: The most effective tool for reducing impacts is to prevent the impacts in the first place through land use management policies that limit impervious surface.

- Watershed Assessment: The County's 2001 *Stream Protection Strategy Baseline Study* provides essential data for making management decisions to protect and improve the health of Occoquan Watershed streams.

- Watershed Planning: The Fairfax County Stormwater Planning Division is working towards developing and implementing Watershed Management Plans for all 30 watersheds throughout Fairfax County. The plans will evaluate strategies for mitigating problems affecting the environment, particularly water quality. They will be based on goals and objectives developed through stakeholder and public involvement.

- Stream Buffers: The County protects vegetated buffers along perennial streams as mandated by the State's Chesapeake Bay Preservation Area Designation and Management Regulations and through the County's EQC process. The value of these stream protection tools is being enhanced by a recent County initiative to more accurately designate perennial streams. This effort is likely to result in significantly more stream miles being protected by vegetated buffers.

- Low Impact Design: Low impact design (LID) describes a suite of techniques that attempts to reproduce pre-development hydrology so that there is no increase in runoff reaching streams and no loss of ground-water recharge. LID encompasses a wide range of construction, site design, and landscaping techniques such as: textured roof tiles; vegetated drainage swales; shared parking and structured parking; narrower street widths; clustering houses; and, biofiltration facilities/rain gardens. The Comprehensive Plan supports the use of LID. Some LID techniques, such as biofiltration, are included in the PFM. Careful evaluation of LID techniques is necessary, however, to ensure their applicability to local conditions. For example, some LID techniques are soil dependent and have not been proven effective on poorly drained Piedmont soils that characterize many portions of the Occoquan Watershed.

- Stormwater Management: While stormwater BMPs adopted for the Occoquan Watershed have prevented further deterioration of drinking water quality in the Reservoir, the County's BMP requirements were not developed with the explicit goal of protecting stream ecosystems. More recently, the County has begun working to make stormwater management facilities less degrading to stream ecosystems.

- Watershed Stewardship: Encouraging good stewardship by watershed residents is widely recognized as critical to protecting stream ecosystems. Fortunately, several stewardship programs are already active in Fairfax County, including in the Occoquan Watershed.

STREAMS AND ECOSYSTEMS FINDINGS AND RECOMMENDATIONS

Findings

1.	Many of the healthiest, most ecologically viable streams in Fairfax County are in the Occoquan Watershed. As demonstrated by the 2001 *Stream Protection Strategy Baseline Study*, however, the ecological health of streams inside and outside the downzoned portions of the Watershed vary significantly, with the former in mostly excellent condition while the picture for the latter is much more mixed. Stormwater runoff from areas with larger percentages of impervious surface is the major cause of stream degradation.
2.	Significant investment was made in stormwater best management practices outside the downzoned areas to improve water quality in the Reservoir, control flooding and erosion, and reduce peak flows. Protection of stream ecosystems, however, was not an explicit goal for these facilities. More recently, the County has given the ecological viability of streams a much higher priority as reflected in the Stream Protection Strategy and watershed management planning programs.

STREAMS AND ECOSYSTEMS FINDINGS AND RECOMMENDATIONS

3.	The most cost-effective approach to preserving the ecological health of streams is to protect them in the first place, as demonstrated by the relatively good condition of streams wholly contained within the downzoned area. Restoration of aquatic ecosystems after degradation is expensive and never returns streams to their pre-development ecological conditions. Because of the low levels of impervious surface, with proper management the outlook for maintaining the ecological health of streams in the downzoned area is quite good. Horse operations and other potential sources of pollution need to be monitored.
4.	Outside the downzoned area, maintaining or restoring the ecological health of many streams will be a greater challenge due primarily to large and increasing levels of impervious surface. Because they were designed primarily to protect Reservoir drinking water quality, the best management practices currently in place have, at best, a modest impact on the degradation of stream ecosystems. Strategies such as low impact design (LID), more stream-friendly stormwater pond design, retrofitting existing developed areas, and public education to encourage behavior changes offer some hope for future improvement. The watershed management planning process in combination with the Stream Protection Strategy offers a vitally important opportunity to examine and recommend ways to provide better stream protection and restoration outside the downzoned area. These County initiatives offer the most comprehensive, in-depth watershed management planning process focused primarily on preservation of stream integrity and water quality.
5.	Streams protection effort both inside and outside the downzoned area benefit from continued assessments. The 2001 *Stream Protection Strategy Baseline Study* provided critical baseline data but could not offer insight into long-term trends. Only an ongoing assessment effort can provide data to keep track of stream health, identify new problems, and assess the effectiveness of stream protection measures over time.
6.	LID techniques offer new options to reduce runoff from new and existing development. Some of these techniques are proven and are in use in the County now; however, questions remain about the applicability and/or effectiveness of some LID techniques.

Recommendations

1.	Rigorously maintain the integrity of the Occoquan downzoning. As demonstrated by the County's 2001 *Stream Protection Strategy Baseline Study*, the downzoning has been an effective measure for the protection of stream ecosystems.
2.	Continue regular long-term stream assessments by the Stream Protection Strategy staff. Such assessments are critical to measuring the County's progress in protecting and restoring stream ecosystems. These assessments should include continued partnership with volunteer stream monitoring efforts. The County should ensure that the Stream Protection Strategy staff is adequately funded and staffed to handle its growing responsibilities.
3.	Fully develop and implement the Stormwater Planning Division's watershed management planning process in the Occoquan Watershed, as well as all other County watersheds. This process represents the County's most focused and comprehensive approach to protecting and restoring stream ecosystems.

STREAMS AND ECOSYSTEMS FINDINGS AND RECOMMENDATIONS	
4.	Study and adopt new stormwater management designs that have been demonstrated to protect or improve the health of stream ecosystems.
5.	Encourage the use of those LID techniques that have been proven effective under local conditions, both where new development is planned and, to the extent feasible, for retrofitting of existing development. The County should further investigate the effectiveness and applicability of LID techniques.

2. Land Use and Open Space Protection – The Key to Both Reservoir and Watershed Protection

Land use policy addressing Fairfax County's portion of the Occoquan watershed is contained within the County's Comprehensive Plan. Land use regulation is contained in the Zoning Ordinance and other chapters of the Fairfax County Code. It is important to note that the Zoning Ordinance and County Code are legal, regulatory documents while the Comprehensive Plan is a non-regulatory, policy document.

As noted earlier in this report, the Fairfax County Board of Supervisors undertook comprehensive land use actions in 1982 to implement its vision of the County's portion of the Occoquan watershed. A primary goal of these actions, as established in the Occoquan Basin Study, was to ensure that there would be "no degradation of the Occoquan water quality resulting from urbanization and agricultural activity in Fairfax County, beyond the level projected for existing and committed development [as of the time of the study]" in the County's portion of the watershed. Nearly 41,000 acres of the watershed were "downzoned" to the R-C (Residential-Conservation) District of the Zoning Ordinance. At the same time, over 1,600 acres of land in the Occoquan watershed near Dulles International Airport were "upzoned" to the I-3 (Light Intensity Industrial) District.

As stated in the Zoning Ordinance, the purpose and intent of the R-C District is:

> *"…to protect water courses, stream valleys, marshes, forest cover in watersheds, aquifer recharge areas, rare ecological areas, and areas of natural scenic vistas; to minimize impervious surface and to protect the quality of water in public water supply watersheds; to promote open, rural areas for the growing of crops, pasturage, horticulture, dairying, floriculture, the raising of poultry and livestock, and for low density residential uses; and otherwise to implement the stated purpose and intent of this Ordinance."*

One effect of the downzoning action was that it established clear boundaries between areas that were to be suburban in character (and that would be the focus of economic development efforts in the watershed) and areas that were to be of a rural or low density residential character. This action also facilitated the efficient provision of public facilities and services by concentrating development in roughly one-third of the watershed.

In addition to the downzoning action, a "Water Supply Protection Overlay District," or "WSPOD," was established in the Zoning Ordinance; the entirety of Fairfax County's portion of the Occoquan Watershed (more than 63,000 acres), excluding road and highway rights-of-way and the Town of Clifton, was placed in this District. This Overlay District established a Zoning Ordinance requirement for stormwater management "best management practices" (BMPs) for any use in the County's portion of the Watershed that requires either a subdivision plan or a site plan. In the R-C District portion of the Watershed, where the establishment of five-acre lots is not subject to the BMP requirement, the low density land use associated with the R-C District was determined to be the appropriate BMP. The Public Facilities Manual was amended in 1980 to require BMPs in the Occoquan watershed; this requirement was strengthened and formalized in the Zoning Ordinance two years later through the establishment of WSPOD. Essentially, structural BMPs were pursued as the primary water quality approach outside the R-C District, while a land use BMP approach was pursued within the R-C District.

Prior to the adoption of the County's Chesapeake Bay Preservation Ordinance in 1993, BMPs were not required outside the Occoquan Watershed, except in cases where such measures were proffered or conditioned in conjunction with the approval of zoning applications. Further, the BMP requirement that was established in WSPOD is more stringent than the BMP requirement that applies for new development outside the Occoquan Watershed; WSPOD requires projected phosphorus runoff pollution to be reduced by 50%, whereas a 40% reduction standard applies in the rest of the County.

The Board's 1982 vision for the County's portion of the Occoquan Watershed has, in general, been realized. The County's portion of the Watershed has developed largely as envisioned in 1982, and this pattern of development has made a positive contribution to the protection of water quality in the Occoquan Reservoir. While the County's portion of the Watershed is not yet built out, vacant and underutilized lands are not prevalent. Much of the development in this area has occurred since 1982; yet, as noted earlier in this report, there has been no evidence that water quality in the Occoquan Reservoir has degraded since 1982. The Task Force concludes that the land use and BMP approaches established by the Board in 1982 have been successful.

The success of the land use efforts in the Occoquan watershed should be celebrated. Yet, continued vigilance is needed to ensure that land use within the Watershed continues to support the protection of the Occoquan Reservoir. In addition, efforts are needed to ensure that high quality ecological conditions of streams in the Watershed are protected or restored. While stream protection was not a focus of the Occoquan Basin Study or the zoning actions that were taken pursuant to that study, it is the Task Force's view that stream protection and restoration should, in keeping with an Objective in the "Environment" section of the County's Policy Plan, be important goals both within and outside the Occoquan watershed.

The Task Force sees several areas where actions are needed in order to maintain and enhance the successful efforts to date. These areas focus on:

- Standards and guidelines associated with uses allowed within the R-C District through Special Permit, Special Exception, or "2232" (public facilities) approval;
- Stream valley/open space protection;
- Development of remaining vacant and underutilized land in the watershed; and
- Environmental stewardship within the watershed.

a) The Zoning, Planning, and Existing Land Use Context

Land use and open space issues need to be considered within the context of zoning and planning. This section of the report provides a brief overview of this context.

Existing Land Use

Much of the Occoquan Watershed in Fairfax County has been developed. Less than 18% of the land area of the County's portion of the Watershed remains vacant, and less than 4% of the County's portion of the Watershed contains underutilized residential land (residentially planned land that is not vacant but that has not been developed to the extent that could occur within planned density ranges as set forth in the Comprehensive Plan). Data regarding underutilized commercially planned land are not available, but it is not expected that such land would comprise a significant area of the Watershed. While redevelopment can potentially occur in some areas that are "built out" (particularly where there are Comprehensive Plan options that are much higher in density than the "low end" of the planned density range--the pending redevelopment of the Dix-Cen-Gato area is a notable example), much of the future development in the Watershed is likely to occur on the vacant and underutilized parcels.

It is important to stress that the terms "vacant land" and "underutilized land" do not reflect value judgments but rather reflect development potential. "Vacant" or "underutilized" land is not necessarily "underdeveloped" land; for example, there are vacant and underutilized parcels in the R-C District that support desirable and viable uses such as riding stables, agriculture, and residential properties greater than ten acres in size. From the standpoint of development potential, though, these properties are highlighted because they have not yet developed to the maximum residential potential allowed under the Zoning Ordinance. However, these same properties may be supporting desirable uses, other than residential, in accordance with the Comprehensive Plan.

Nearly 70% of the vacant land in the County's portion of the Occoquan Watershed is located in the R-C District. Over 79% of the underutilized residential land is likewise located in the R-C District. The total amount of vacant and underutilized land in the R-C District in the Occoquan Watershed represents about 24% of the area of the R-C District. Much of the vacant and underutilized land in the R-C District is located in areas with soils that are poorly suited to

traditional onsite sewage disposal systems (i.e., septic systems and associated drainfields). Some of the vacant and underutilized land is located in Agricultural and Forestal Districts. Vacant and/or underutilized areas of particular note are: areas west of Cub Run; areas between Braddock and Popes Head Roads; an area along Shirley Gate Road; an area south of Popes Head Road and west of Colchester Road; areas along Compton Road; and an area near Hemlock Overlook Regional Park. Other vacant and underutilized parcels are located in areas that are largely developed; the future development of these parcels will, therefore, be of an "infill" character. Almost the entirety of the R-C District is outside the approved sanitary sewer service area

Outside the R-C District, areas where vacant and underutilized parcels are prevalent include the Westfields area, other areas in the Dulles Suburban Center (the Route 28/Centreville Road and Route 50 corridors near Dulles Airport, and the industrially-zoned area between Westfields and Route 50), areas between I-66 and Route 29 east of Centreville (some of which are now being developed), and areas along Thompson and Oxon Roads. A number of vacant or underutilized "infill" parcels are also present. These areas are all within the area approved for sanitary sewer service.

The Zoning Process and By-Right Development

Every property in Fairfax County is zoned. Each zoning district in Fairfax County's Zoning Ordinance has a list of "permitted uses," a list of uses that can be allowed through the approval of a "Special Permit" by the County's Board of Zoning Appeals (BZA), and a list of uses that can be allowed through the approval of a "Special Exception" by the County's Board of Supervisors (BOS). In addition, each zoning district specifies, among other things, maximum allowable floor areas for nonresidential uses (expressed as a ratio of floor area of structures to lot area), minimum lot areas, and open space requirements. Land owners may pursue the development of "permitted uses" as long as such development meets all applicable zoning requirements and other County Code requirements; no special permission by the BOS or BZA is needed. In land use jargon, such development is referred to as "by-right" development.

If a developer or landowner requests a change to the zoning of a property, or if a developer or landowner applies for a use that requires a Special Exception, the proposed development will be subject to public hearings before the Planning Commission and BOS. The BOS may approve or deny such applications. In the case of rezonings, approvals are typically subject to a set of "proffers," or voluntary commitments, offered by the applicant. In the case of Special Exceptions, approvals are typically subject to a set of Board-imposed development conditions. In the case of Special Permits, each application is subject to a public hearing before the BZA, and the BZA has the authority to approve or deny such applications. Approved applications are typically subject to development conditions imposed by the BZA. Of particular note regarding these processes is that County staff, the Planning Commission, the BOS, and the BZA have the ability to review applications for conformance with Comprehensive Plan policies and to seek commitments (or, in some cases, to impose conditions) that go above and beyond minimum zoning or County Code requirements. These opportunities are not available for by-right development.

b) The Open Space/Stream Valley Preservation Context

It is also important to understand the mechanisms through which open space/stream valley areas are, and can be, protected in order to better understand the implications of future changes to land use in the Watershed. To a significant extent, these mechanisms are tied to the process through which development occurs. Open space protection mechanisms can be characterized as being regulatory, policy driven, or voluntary.

Regulatory Mechanisms

Regulatory protection mechanisms include the County's Chesapeake Bay Preservation Ordinance (Chapter 118 of the Fairfax County Code) and the Floodplain Regulations of the Zoning Ordinance. The Chesapeake Bay Preservation Ordinance establishes designation and use criteria for Resource Protection Areas (RPAs). In the County's portion of the Occoquan Watershed, RPAs presently include "tributary" streams (perennial streams that are so depicted on U.S. Geological Survey maps), associated wetlands, and 100-foot buffer areas around these features.

New State regulations will require all perennial streams to be protected through RPA designation regardless of how they are depicted on maps; this requirement, which must be implemented by March, 2003, will result in a significant expansion to the County's RPA network. While a number of uses are either allowed within RPAs or exempt from RPA requirements, and while other uses can be pursued through applications to the County for exceptions, the RPA is an area that is generally protected from disturbance.

The Floodplain Regulations of the Zoning Ordinance have the effect of limiting the extent of land disturbance that can occur in floodplains. As defined by these Regulations, the "floodplain" includes all areas that would be flooded by the rainfall event that is expected to occur, on average, once every 100 years, for any stream that collects drainage from an area greater than 70 acres. "Minor floodplains" are associated with streams that collect drainage from areas between 70 and 360 acres. Floodplains associated with larger streams are commonly referred to as "major floodplains." While any use can technically be permitted in a minor floodplain, a set of "use limitations," including hydrologic and environmental considerations, limit actual encroachments. There is a limited list of uses that are allowed in major floodplains; however, additional flexibility is afforded through the Special Exception process.

All development activities in the County must comply with both the Floodplain Regulations and the Chesapeake Bay Preservation Ordinance, even if they are pursued through the "by-right" approach. While both of these regulatory approaches protect significant amounts of sensitive stream valley lands, they do not provide for comprehensive stream valley protection. For example, the required 100-foot buffer area associated with RPAs may or may not include the entirety of a steeply sloping area adjacent to a stream. Further, intermittent streams are not (and will not be) protected under the Chesapeake Bay Preservation Ordinance, and the Floodplain Regulations do not protect streams

with drainage areas of less than 70 acres. Further, the Floodplain Regulations do not ensure that streams will be provided with substantial vegetated buffer areas. Hypothetically, clearing could occur to the edge of a stream where the stream flows along a floodplain boundary and where the stream is not perennial.

Policy-Driven Mechanisms

Policy-driven open space protection includes the acquisition of park land by the County or other governmental entity, in that policy decisions are made regarding the type, character, and extent of land that warrants acquisition. The preservation of undisturbed open space is one of the most effective tools for ensuring good water quality in any watershed. The Fairfax County Park Authority and the Northern Virginia Regional Park Authority are the largest landholders and preserve thousands of acres of undisturbed open space in the Occoquan Watershed. Because of their extensive holdings of undisturbed open space, the Park Authorities are important land stewards in the Occoquan Watershed. The County's Board of Supervisors has been particularly active recently in the acquisition of park land in the R-C District of the Occoquan Watershed, and the Northern Virginia Regional Park Authority maintains substantial land holdings along the shoreline of the Occoquan Reservoir.

The County's Environmental Quality Corridor (EQC) policy is another notable policy-oriented approach to open space protection. The EQC system is an open space system designed to link and preserve natural resource areas and provide passive recreation. Unlike RPA requirements or the Floodplain Regulations, the EQC policy, which is within the Environment section of the County's Policy Plan, focuses on stream valley and other ecologically-valuable lands from a holistic perspective; the stream valley component of the policy recommends the protection of floodplains, associated wetlands, adjacent steep slopes (15% or greater slope gradients), and a slope-based minimum buffer area. The application of this policy is not limited to streams with specific drainage areas; indeed, the County has established EQCs in headwater areas of streams.

While the EQC policy provides a more comprehensive framework for the protection of stream valleys and other ecologically valuable land than do the Floodplain Regulations or Chesapeake Bay Preservation Ordinance, EQC protection is not required by County ordinance. Rather, the policy is implemented through negotiations with developers during the reviews of zoning applications such as rezonings, Special Exceptions, and Special Permits. During the reviews of zoning applications, staff from the Department of Planning and Zoning formulates recommendations regarding EQC designations, negotiates with applicants for commitments to the protection of these areas, and forwards recommendations to the applicable reviewing authority/ies. In general, zoning applications that propose disturbance to EQCs (allowing for unavoidable encroachments, such as some road crossings and utility lines, and allowing for trail construction) are not approved. The EQC policy can also serve as the basis for acceptance of Open Space Easements by the County. Where applied, the EQC policy has been successful in protecting stream valleys and other sensitive areas. However, EQC protection is not a requirement for by-right development, and landowners are not prohibited from clearing into areas of their properties that might otherwise qualify for EQC designation.

Voluntary Mechanisms

A number of voluntary measures can be taken by landowners to protect environmentally sensitive lands. Conservation and Open Space easements, for example, are effective tools for the long-term protection of open space. These easements can also heighten awareness of the importance of proper stewardship in protecting the Occoquan Reservoir. The County has established an "Open Space Easements" program through which the Board of Supervisors can accept easements donated by property owners; in some cases, property owners attain tax benefits by donating these easements. The County has also entered into a public-private partnership with the Northern Virginia Conservation Trust in order to enhance easement acquisition efforts in the County.

Fairfax County also has an Agricultural and Forestal District program. Eligible landowners may apply to the Board of Supervisors to place their land in such districts and to attain the tax benefits that are associated with the Agricultural and Forestal District designation. Through this program, environmentally sensitive areas of subject properties can be protected for the duration of the District designation (at least eight years). In addition, conservation plans are developed in coordination with the Northern Virginia Soil and Water Conservation District in order to minimize pollutant runoff from agricultural and forestal operations. Several of the larger vacant and underutilized properties in the Occoquan Watershed are located in Agricultural and Forestal Districts.

Another voluntary approach is environmental stewardship of private property. Environmentally sensitive lands need not be owned or regulated by the government in order to be protected; a strong environmental ethic among landowners in the Watershed can also serve to protect these areas. Government can foster such an ethic through educational efforts. A potential tool for increasing awareness of proper land stewardship is to enlist the services of volunteer organizations, the real estate industry, and homeowner associations to help with education.

c) Development Potential in the R-C District

By-Right Development

As noted earlier, most of the vacant and underutilized land remaining in Fairfax County's portion of the Occoquan Watershed is located in the R-C District. There are nearly 9,600 acres of such land in the R-C District, which is less than 24% of the area of this District. Much of this land remains undeveloped because of soil constraints to on-site sewage disposal systems. If alternative on-site sewage treatment/disposal technologies were to be applied (see the discussion later in this report), much of the remaining vacant and underutilized land in the R-C District would likely be developed at some time in the future. With the exception of Special Permit and Special Exception uses, however, this development would be of the "by-right" variety, as rezoning of land in the R-C District would be inconsistent with Comprehensive Plan policy and therefore would probably not be supported by the Board of Supervisors.

Because much of the future development in the R-C District will be by-right in nature, because regulatory approaches to open space protection will not protect all stream valley areas (and other environmentally sensitive areas) from disturbance associated with such development (see the discussion above), because much of the Watershed has already developed to its planned density, and because land stewardship efforts that can impact water quality (e.g., residential lawn care) fall outside the realm of government regulation, the need for voluntary stewardship efforts on the part of landowners will become increasingly important to the protection of the Occoquan Reservoir.

Special Exceptions and Special Permits

Since the downzoning action in 1982, the R-C District of the Zoning Ordinance has been amended twelve times; each of these amendments added new Special Exception or Special Permit uses in the District. Examples of some of the added uses include: accessory dwelling units, residence halls, golf driving ranges, home child care facilities, cultural centers and museums, bed and breakfasts, institutions providing housing and general care for the indigent, regional sewage treatment and disposal facilities, private clubs, temporary mobile and land based telecommunication testing facilities, nursery schools, private schools of general education, and places of worship with a nursery school or private school of general education. It is important to note that none of these uses was added as a "by right" use; all such uses require the approval of either the Board of Supervisors or Board of Zoning Appeals.

Since 1982, there have been several dozen Special Exception and Special Permit uses approved in the R-C District. These uses have included: religious institutions; private schools; plant nurseries; cluster subdivisions; electrical substations; sewage treatment and related facilities; and recreational uses such as athletic fields, golf courses, driving ranges, swimming and tennis clubs, and riding and boarding stables. Due to the scarcity of large, relatively inexpensive parcels of land, there are few areas of the County outside the R-C District that are available or feasible for larger Special Permit or Special Exception uses. As a result, there have been requests and approvals for relatively large regional-oriented uses or facilities in the R-C District. It is likely that new proposals for such uses in the R-C District will continue to be filed in the future.

The Zoning Ordinance allows floor area ratios of up to 0.10 for private nonresidential uses and up to 0.15 for public uses. For a hypothetical 20-acre parcel in the R-C District, therefore, up to two acres of floor space could be provided for a private school or religious institution and up to three acres of floor space could be provided for a public use. With respect to overall impervious cover on a site, the Zoning Ordinance establishes minimum parking requirements but does not establish any caps on impervious cover.

The Zoning Ordinance establishes a requirement of 50% open space in the R-C District for cluster subdivisions but does not establish any other open space requirements. The 50% open space for cluster subdivisions is not required to be undisturbed open space. Finally, the Zoning Ordinance requires the following for cluster subdivisions in the R-C District: ". . . the applicant shall demonstrate that the cluster subdivision and the use of its open space is designed to achieve

runoff pollution generation rates no greater than would be expected from a conventional R-C District subdivision of the property." There are no specific water quality standards for other Special Permit or Special Exception uses in the R-C District.

Special Exception and Special Permit uses in the R-C District are reviewed for conformance with the Comprehensive Plan. Comprehensive Plan land use recommendations for planning sectors that are located, at least in part, in the R-C District typically include text similar to the following:

> *Non-residential uses requiring special exception or special permit approval should be rigorously reviewed. In general, these uses, if permitted at all, should only be located at the boundary of Low Density Residential Areas and Suburban Neighborhoods or where their impact on existing residences is minimal. These uses should be granted only if the following conditions are met:*
>
> - *Access for the use is oriented to an arterial roadway;*
> - *The use is of a size and scale that will not adversely impact the character of the area in which it is located; and*
> - *The use is designed to mitigate impacts on the water quality of the Occoquan Reservoir.*

The last bullet point is broad in nature and does not establish a quantifiable guideline; "mitigation of impacts" may mean different things to different people. In reviewing Special Exception and Special Permit applications in the R-C District, County staff typically pursues an approach whereby a minimum of 50% perpetually undisturbed open space is recommended along with structural BMP controls for the portion of the site that develops. In most, but not all, cases where this recommendation has been made, approved Special Permits and Special Exceptions have reflected this approach. Through the preservation of at least half of the subject property as perpetually undisturbed open space, the applicant can demonstrate that the BMP requirement of WSPOD can be satisfied through the protection of open space; in this manner, land use serves as a BMP.

This land use approach, along with the provision of structural controls for the developed portion of the site, ensures that water quality protection for the site will exceed the minimum WSPOD BMP requirement. However, this approach does not ensure that pollutant runoff rates from the developed site will be less than or equal to the pollution runoff rates that would be anticipated from a conventional R-C District residential development of the site. Impervious cover associated with Special Permit and Special Exception uses in the R-C District typically exceeds what would be anticipated for a five-acre lot residential development, and therefore pollutant runoff rates for such uses could conceivably exceed rates associated with a five-acre lot residential development, even with water quality efforts that exceed minimum WSPOD requirements. The increased impervious cover can also result in increased volumes of stormwater runoff. These increased volumes have a higher potential to degrade streams downstream of these sites than the volumes of stormwater runoff that would be associated with lesser amounts of impervious cover.

Public Facilities

Public facilities and utilities, including schools, parks, libraries, fire stations, and other facilities, are reviewed by the Planning Commission for general conformance with the County's Comprehensive Plan as provided under Section 15.2-2232 of the Code of Virginia. This Code section requires that the general location, character, and extent of a proposed public facility be determined by the local Planning Commission to be substantially in accord with the adopted comprehensive plan. Except for facilities and utilities that are a current feature identified on the Plan, the Planning Commission holds public hearings on all "2232 Review" applications. Facilities and utilities that are a current feature of the Plan are reviewed by the Commission without a public hearing under the "feature shown" process. While there are no explicit water quality-based guidelines for the review of public facility applications in the R-C District, County staff reviews public facility uses in a similar manner to Special Permit and Special Exception uses.

The Park Authorities provide some recreational facilities such as playing fields, golf courses, and marinas on a small percentage of the park landholdings in the Watershed. Any expansion of publicly owned recreational facilities requires standard planning and zoning approvals including a 2232 Review. The County reviews Park Authority applications in the same way that it does other Special Exception and Special Permit applications. Developed parklands are required to provide stormwater management BMPs to retain and treat runoff.

Road projects pursued by the Virginia Department of Transportation (VDOT) are reviewed locally through Citizen Information Meetings and the Location and Design public hearing process. Prior to approval by the Commonwealth Transportation Board (CTB), all projects are presented to the Board of Supervisors for endorsement. The general locations and design criteria of these projects are guided by the County's Comprehensive Plan, and the County's Department of Transportation coordinates closely with VDOT regarding design and engineering details.

With respect to environmental protection, VDOT road projects are exempt from local ordinances adopted pursuant to Virginia's Chesapeake Bay Preservation Act but are subject to Virginia's Erosion and Sediment Control Law and Virginia's Stormwater Management Regulations (which include stormwater management and water quality control requirements). Engineering reviews for VDOT projects are undertaken at the State level of government with coordination and input from the County Department of Transportation staff.

d) Development Potential Outside the R-C District

As noted earlier in this report, only 17% of the Occoquan Watershed is located in Fairfax County. As such, much of the Watershed's development potential outside the R-C District lies outside Fairfax County. However, this section of the report will focus on that portion of the Watershed that is located within Fairfax County and that is outside the R-C District.

As noted earlier, the majority of vacant land and underutilized residential land in the Occoquan Watershed in Fairfax County is located in the R-C District. However, there are over 3,300 acres of vacant land and nearly 500 acres of underutilized residential land in that portion of the Occoquan Watershed in Fairfax County that is outside the R-C District. Some of this land is already being developed. It is not known how much of the remaining land will develop through a by-right process and how much will go through a zoning process (rezoning, Special Exception, or Special Permit). However, some of the development in this area will be of an infill character. The potential for the redevelopment of existing developed parcels is also possible. The Rockland Village and Dix-Cen-Gato areas are two examples where such redevelopment is occurring, and other older developed areas may follow suit. There may be opportunities for water quality improvement in these areas, as older developed parcels without water quality controls are replaced with newer developments with controls. With the exception of minor development projects (e.g., additions to existing structures that don't require site plans; construction of individual houses on existing lots), all development outside the R-C District will be subject to the BMP requirement of WSPOD.

It is likely that the development of vacant and underutilized parcels in the Occoquan Watershed outside the R-C District will result in significant increases in impervious cover on these parcels. The additional volumes of stormwater runoff that will be generated by the increased impervious cover may, in turn, result in increased stream degradation in downstream areas.

As noted earlier in this report, increases in stormwater runoff volumes can be reduced through the application of low impact site design techniques such as the minimization of impervious surfaces (e.g., reduction in off-street parking, provision of narrow roadways, siting buildings to reduce impervious cover, use of pervious parking surfaces) and the conveyance of runoff from impervious surfaces into pervious areas (e.g., elimination of curb and gutter, conveyance of drainage into biofiltration facilities/rain gardens, conveyance of drainage into infiltration swales). The Comprehensive Plan was amended by the Board of Supervisors in 2000 to support the application of such techniques. While the County has taken actions to support some of these techniques (e.g., recognition of biofiltration facilities and other innovative stormwater management efforts in a Letter to Industry), there are a number of impediments to the application of these techniques, including site, process, and regulatory constraints. County staff has begun to investigate such impediments as they relate to current County process and regulatory requirements.

Another effort that can serve to address stream protection and restoration in a comprehensive manner is watershed management planning. The Department of Public Works and Environmental Services has initiated a multi-year watershed management planning effort that picks up from the recently completed Stream Protection Strategy Baseline Study.

LAND USE AND OPEN SPACE FINDINGS AND RECOMMENDATIONS

Findings

1.	With the successful implementation of the UOSA Water Reclamation Facility (WRF), land use management and open space protection are the County's major tools for protecting the Occoquan Watershed's streams and ensuring the long term viability of the Occoquan Reservoir as a drinking water supply.
2.	The County's strategy for land use protection and development in the Occoquan Watershed has been largely implemented—The Board of Supervisors' 1982 vision for the County's portion of the Watershed has, in general, been realized, with large lot residential development characterizing the downzoned area of the Watershed and higher density development concentrated in the 1/3 of the Watershed area that wasn't downzoned.
3.	The pattern of development established pursuant to the Board's 1982 zoning actions has made a positive contribution to protecting water quality in the Occoquan Reservoir.
4.	One effect of the downzoning action was that it established clear boundaries between areas that were to be suburban in character (and that would be the focus of economic development efforts in the watershed) and areas that were to be of a rural or low density residential character. This action also facilitated the efficient provision of public facilities and services by concentrating development in roughly one-third of the Watershed.
5.	While the County's portion of the Watershed is not yet built out, vacant and underutilized lands are not prevalent. Less than 18% of the land area of the County's portion of the Watershed remains vacant, and less than 4% of this area contains underutilized residential land. The vacant and underutilized land is not necessarily "underdeveloped," in that some of this land in the R-C District contains desirable and viable uses (e.g., riding stables, agriculture, large residential parcels). Most of the vacant and underutilized land is located in the R-C District; however, less than 24% of the land area of the R-C District in the Occoquan Watershed remains vacant or underutilized. There are a few areas characterized by large areas of vacant land (particularly in unsewered areas where soil conditions are not conducive to onsite sewage disposal); however, much of the remaining development that will occur in the County's portion of the Watershed will be of an infill or redevelopment nature.
6.	With the exception of Special Permit and Special Exception uses, future development in the R-C District will be of a by-right character. This has implications for the mechanisms through which unregulated sensitive environmental areas can be protected, as there will be limited opportunities to seek protection of such areas through the zoning process.
7.	While most of the area outside the R-C District in the Occoquan Watershed in Fairfax County has been developed, there is still some development potential remaining on vacant and underutilized parcels in this area. In addition, established communities in the Watershed are being redeveloped (e.g., the Rockland Village and Dix-Cen-Gato areas), and other developed areas of the Watershed may redevelop in the future. It is likely that future development outside the R-C District will result in significant increases in impervious cover on the sites that will be developed. If low impact site design techniques were to be applied (where feasible and appropriate), some of the adverse impacts that could be anticipated as a result of the increased impervious cover may be reduced.

LAND USE AND OPEN SPACE FINDINGS AND RECOMMENDATIONS

8.	Because much of the Watershed has developed, voluntary stewardship efforts on the part of landowners will become increasingly important to the continued protection of water quality in the Occoquan Reservoir. Nonregulatory approaches to the protection of open space (e.g., easement agreements, education) will also become increasingly important.
9.	By preserving thousands of acres of undisturbed open space, the Fairfax County Park Authority and Northern Virginia Regional Park Authority are important land stewards in Fairfax County's portion of the Watershed. The County's Board of Supervisors has been particularly active recently in the acquisition of park land in the R-C District of the Occoquan Watershed
10.	The Comprehensive Plan supports the use of low impact site design techniques. The application of such techniques in the Occoquan Watershed can reduce water quality impacts of development and provide additional protections to water quality in the Occoquan Reservoir.
11.	Fairfax County has initiated a multi-year, comprehensive watershed management planning effort. This effort will enable the County to determine how to optimize stormwater management, water quality controls, and stream protection throughout the Occoquan Watershed in Fairfax County.
12.	Special Permit and Special Exception uses that have been approved in the R-C District of the Occoquan Watershed have often been more intense (in terms of impervious cover and, conceivably, pollutant runoff rates) than conventional R-C District residential development would have been. With the exception of R-C cluster subdivisions, there are no clear water quality based standards or guidelines (e.g., pollutant loadings, impervious cover, undisturbed open space protection) for Special Permit and Special Exception uses in the R-C District of the Occoquan Watershed.

Recommendations

1.	At a minimum, continue the County's commitment to the successful strategy for water quality protection of the Occoquan Reservoir that was established through the comprehensive zoning actions that were taken in 1982.
2.	Establish a broad-based advisory committee, to include stakeholders, County staff, and one or more members of the County's Planning Commission, to review standards and guidelines associated with Special Permit, Special Exception, and public uses that may be approved in the R-C District in the Occoquan Watershed and to report its findings and recommendations to the Board of Supervisors. The advisory committee should: • Review the maximum allowable floor area ratios currently allowed in the R-C District in light of overall impervious surface implications, public use/facility needs, institutional use needs, recreational needs, and the purpose and intent of the 1982 downzoning action. • Recommend zoning standards, performance standards, and/or Comprehensive Plan guidelines for total impervious cover and/or undisturbed open space. • Review the combined impact of the facility footprint and total impervious surface cover, including parking. • Determine if it would be appropriate to establish clearer guidance in the Comprehensive Plan

LAND USE AND OPEN SPACE FINDINGS AND RECOMMENDATIONS

	regarding the circumstances under which Special Exception and Special Permit uses (as well as public uses reviewed during the 2232 process) can be considered to be "designed to mitigate impacts on the water quality of the Occoquan Reservoir."
3.	Establish a more proactive easements program that provides for outreach efforts to owners of land in the Occoquan Watershed that contains environmentally sensitive resources, particularly where these resources would not otherwise be protected by regulation.
4.	Fully fund watershed management planning efforts as well as the implementation of adopted plan measures. As part of the planning process: • Investigate the effectiveness of existing stream valley protection mechanisms. Identify additional regulatory and/or non-regulatory measures, if any, that may be needed in order to ensure that stream valleys will be protected adequately. • Identify additional performance requirements that may be appropriate to ensure that by-right development in the R-C District will not adversely affect stream quality.
5.	Complete the ongoing review of impediments to the application of low impact site design techniques and identify disincentives and policy/regulatory conflicts associated with the implementation of these techniques. Determine if and how these disincentives, impediments, and conflicts can be overcome so as to increase the application of such techniques in the Occoquan Watershed. Investigate incentives and requirements that could be pursued to increase the application of these practices.

3. Impervious Surfaces

Although discussed in the previous section, issues associated with impervious surface cover in the Occoquan Watershed deserve additional focused attention. One of the purposes of the R-C District, as stated in the Zoning Ordinance, is "to minimize impervious surface and to protect the quality of water in public water supply watersheds." Further, it states the R-C District will "promote open, rural areas for the growing of crops… and for low density residential uses." The Zoning Ordinance does allow certain non-residential uses in the R-C District. For these uses, it sets maximum floor area ratios (FARs) of 0.10 for private non-residential uses and up to 0.15 for public uses in the R-C District. In addition the Ordinance establishes minimum parking requirements. However, despite the purpose laid out in the R-C District, the Ordinance does not set a limit on impervious cover. The result could be an allowed use that covers a significant portion of a parcel with impervious surface, primarily in the form of a parking lot.

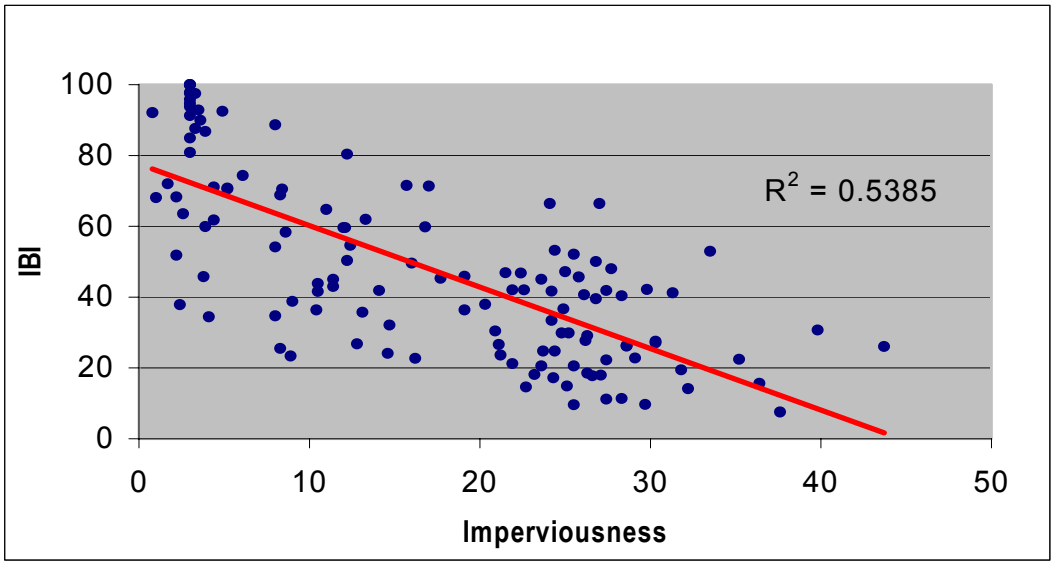
The Comprehensive Plan provides that non-residential uses in the R-C District requiring Special Exception or Special Permit approval should be rigorously reviewed and should be granted only if, among other conditions, "the use is designed to mitigate impacts on the water quality of the Occoquan Reservoir." As stated earlier in this report, impervious cover associated with Special Permit and Special Exception uses in the R-C District typically exceeds what would be anticipated for a five-acre lot residential development, and therefore pollutant runoff rates for such uses can be

expected to exceed rates associated with a five-acre lot residential development, even with water quality efforts that exceed minimum WSPOD requirements. The increased impervious cover can also result in increased volumes of stormwater runoff. These increased volumes have a higher potential to degrade streams downstream of these sites than the volumes of stormwater runoff that would be associated with lesser amounts of impervious cover.

As forests and undeveloped open spaces are converted to roads, rooftops, parking lots and other impervious surfaces, the land is less able to absorb rainfall and mitigate runoff. The result is that stormwater runoff will increase in volume and velocity, carrying with it various pollutants, such as fertilizer, pesticides and herbicides, and vehicular contaminants, that will both degrade stream water quality and erode stream banks and beds.

The percentage of impervious surface has a related impact on downstream properties and waterways, i.e., the greater the amount of impervious surface the greater the impacts. According to an analysis conducted by the Northern Virginia Regional Commission in 2000 of the impervious surface cover in the Occoquan Watershed, both within and outside the R-C District, the total imperviousness was 9 to 12%. However, the imperviousness of many of the Occoquan subwatersheds was far in excess of 25%. According to the 2001 Stream Protection Strategy Baseline Report, in those parts of the Watershed with a low percentage of impervious surface, the quality of the streams tended to be Good to Excellent whereas those streams in the Watershed outside the R-C District were mostly Poor to Good. Figure 13 shows the relationship between percent imperviousness versus Index of Biotic Integrity as taken from the 2001 *Stream Protection Strategy Baseline Study*.

Figure 13. Percent imperviousness versus Index of Biotic Integrity in Fairfax County. (Source: Stream Protection Strategy Baseline Study)



The potential exists for the development of 3,300 acres of vacant land and nearly 500 acres of underutilized residential land in the Occoquan Watershed in Fairfax County outside the R-C District. All development in this area except for individual homes on

existing lots will be subject to the WSPOD requirement for BMPs. It is likely that such development will result in significant increases in impervious cover on these parcels. The additional volumes of stormwater runoff that will be generated by the increased impervious cover may, in turn, result in increased stream degradation in downstream areas in terms of water quality, stream bank erosion, and sedimentation.

As already noted in this report, increases in stormwater runoff volumes can be reduced to some degree through the application of low impact site design techniques such as the minimization of impervious surfaces (e.g., reduction in off-street parking, provision of narrow roadways, siting buildings to reduce impervious cover, and use of pervious parking surfaces) and the conveyance of runoff from impervious surfaces into pervious areas (e.g., elimination of curb and gutter), conveyance of drainage into biofiltration facilities (also known as "rain gardens"), and conveyance of drainage into infiltration swales.

See related findings and recommendations in section 1. "Streams and Ecosystems" and section 2. "Land Use and Open Space" above.

4. Tree Cover

While not specifically addressed in the 1982 downzoning effort, the preservation of tree canopy is an important component of the health of the Occoquan Watershed. This is of special concern because the County has only limited legal authority to prevent the removal of much of this canopy through permitted development or redevelopment.

Even with the stormwater management and erosion and sediment control initiatives described above, there will be little clear authority to regulate clear cutting of large stands of existing urban forests associated with permitted land disturbing activities. While the Chesapeake Bay Preservation Ordinance stipulates that only clearing necessary for the proposed use be allowed in a Resource Management Area, applicants who propose uses that require large cleared areas on their property have the ability to gain approval to do so. This has been evidenced by the recent clear cutting and development of several large residential projects outside the R-C District of the Occoquan Watershed.

Loss of individual trees, specimen trees, historic trees, and/or forests or stands of trees can result in a major change to an existing environment. Not only are the trees lost, but so is "neighborhood open space." While the land is not owned or controlled by the community, undeveloped or underdeveloped property does provide open space benefits to a community. Tree preservation can lessen the impacts of new construction. Once trees are removed and construction commences, the impact of change becomes readily evident; even when the process has included public input, citizens may still be unhappy with the resultant development, especially with the loss of open space.

In 1995, the Board of Supervisors established the Tree Preservation Task Force, which then identified a number of initiatives to provide for additional tree preservation during the development process. Task Force initiatives relevant to land

development, as well as other proposed changes to the development standards and processes, were incorporated into the staff recommendations contained in the Infill and Residential Development Study.

The Infill Study's tree preservation initiatives were designed to build upon the previous Tree Preservation Task Force initiatives and have resulted in additional recommended efforts to reduce tree loss by:

- Reducing grading to increase tree preservation
- Studying and enhancing, where possible, the heritage and specimen tree legislation
- Requesting conservation easements where appropriate

A common misperception about the County's authority to regulate tree cover and tree removal is that there is a specific County Tree Cover Ordinance. In reality, there are a series of requirements governing preservation and planting within the County Code. This grouping of requirements encompass the following parts of the County Code:

- PFM, Chapter 12, "Tree Preservation and Planting:" Technical specifications for conservation plans, tree cover, and field standards.
- Section 13 of the Zoning Ordinance "Landscaping and Screening:" Covers parking lot landscaping, transitional screening, and tree cover.
- Chapters 104 and 118: Require tree conservation indirectly via erosion and sedimentation control and water quality management requirements.
- Chapter 101: Requires that tree cover requirements of the Zoning Ordinance and PFM be met.
- The Policy Plan of the Comprehensive Plan: States that tree preservation should be maximized as a development criterion in zoning cases.

The Tree Preservation and Planting Requirements allow Fairfax County Government to minimize the removal of vegetation during the land development process and to ensure that trees and associated vegetation are conserved in a manner that maximizes their ecological, environmental, and socio-economic benefits for both the new and existing communities. Unless specifically proffered or protected by a Conservation Easement or Chesapeake Bay Preservation Area, however, there is little authority to require preservation of existing tree cover. The County has and continues to pursue State enabling legislation to better protect existing vegetation and to encourage land developers to use existing tree cover to meet their tree cover requirements rather than through replanting.

Re-establishment of native forest cover within the Occoquan Watershed can be achieved largely through citizen and private group efforts. Fairfax ReLeaf, Inc. is a non-profit organization that is supported by Fairfax County and is dedicated to planting trees on public lands and providing educational programs about the values of trees. Fairfax ReLeaf, Inc., founded in 1991 and associated with Global ReLeaf (a program of American Forest), has planted over 100,000 tree seedlings along public highways and in riparian stream valley settings in our community. Other agencies and organizations are also very involved in tree planting efforts.

TREE PRESERVATION FINDINGS AND RECOMMENDATIONS	
Findings	
1.	The loss of tree canopy results in increased erosion and sedimentation and stormwater runoff. The County does not currently have all the tools necessary to adequately address tree preservation and conservation.
Recommendations	
1.	Continue to press for tree conservation and preservation enabling legislation.
2.	Establish tree canopy goals for the Occoquan Watershed and determine appropriate implementation measures for attaining those goals. Tree preservation, not removal and replacement, should be the primary means of achieving the goal.
3.	Encourage the revegetation of lost riparian stream buffers with native woody vegetation by identifying potential reforestation areas, providing citizen education, and encouraging citizen reforestation efforts.

5. Erosion and Sediment Control and Stormwater Management

The need to control erosion and sediment, as well as the need to manage stormwater runoff, are directly related to the removal of tree canopy and increased impervious surfaces. Since a significant proportion of future development in the Occoquan Watershed will be infill in nature, the Task Force turned to the County's Infill and Residential Development Study. The Study covered numerous facets of infill and redevelopment, including challenges regarding stormwater management and erosion and sedimentation. As a result, the Study provided a framework for discussion of issues as well as policy and regulatory reform concerning residential development in the Occoquan Watershed.

Recommendations presented in the Infill and Residential Development Study that will benefit the Occoquan Watershed included:

- An enhanced erosion and sediment control program involving improvements in education, policy, regulations, and enforcement as well as implementation of innovative practices.
- Adoption of innovative BMP practices to reduce impact during development and allow greater flexibility in the engineering of proposed sites.
- Improved design and performance of proposed stormwater management facilities by implementing a technical review of certain components during the rezoning process.
- Continued policy of requiring additional development conditions associated with stormwater detention/water quality waivers to address potential problems associated with land disturbance.

- Enhanced requirements and better definitions during the design process for design professionals for evaluating the adequacy of stream channels for increased runoff due to new developments.
- Recommendations to amend the Public Facilities Manual to:
  - Include technical definitions pertaining to the adequate outfall of stormwater from developments;
  - Require a formal adequate outfall analysis in conjunction with review of proposed construction plans;
  - Give the Director of DPWES discretion to require additional measures where a proposal will discharge into an inadequate channel; and,
  - Better define the design procedure for pipe outlets and suggest consideration of a recent Virginia Department of Conservation and Recreation proposal pertaining to hydrologic design/stormwater design.
- Additional guidance on BMP selection and enhanced design standards in the PFM.
- Establishment of a County-wide monitoring program to assess BMP performance.
- Allowance of BMP credit for contributions to a "land trust fund."
- Enablement of the implementation of bioretention/biofiltration facilities ("rain gardens"), underground sand filters in residential areas, and Manufactured or Ultra Urban BMP systems in Fairfax County as acceptable privately maintained BMPs.
- Linkage of enhanced design features for extended detention and retention pond BMPs to increased pollutant removal efficiencies.
- Recommendations for the retrofitting of existing stormwater detention-only ponds for water pollution treatment.
- Identification and survey of water impoundments downstream of a proposed development that could be impacted by a proposed development, and assignment of accountability for impact resolution.
- Adoption of a program to retrofit existing stormwater control facilities that were not initially designed to perform a water quality benefit to provide this added function as well.

In addition to implementation of the erosion and sedimentation initiatives recommended in the Infill Study, the County has developed and is implementing an Alternative Erosion and Sediment Control Inspection Program, in accordance with the State of Virginia's guidelines. This Alternative Inspection Program identifies proposed new or redevelopment land disturbing projects according to proximity to sensitive environmental features and prioritizes the inspections accordingly. Prioritization then enables the inspector to visit sites adjacent to such features on a more frequent basis to help ensure that the erosion and sediment controls are maintained and properly functioning.

Although these many stormwater and erosion and sediment control initiatives have been and will continue to be beneficial to the Occoquan Watershed, challenges will continue with regard to increased stormwater volumes from creation of additional impervious areas on single lot developments.

EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT FINDINGS AND RECOMMENDATIONS

Findings	
1.	The County's Infill and Residential Development Study, accepted by the Board of Supervisors in January, 2001, has particular relevance to the Occoquan Watershed, where much of the new development will be in the form of infill and where existing older land uses throughout the Watershed have the potential to be redeveloped.
2.	The Task Force remains concerned that current staff resources are not sufficient to enforce the Erosion and Sediment Control Ordinance. This issue needs and deserves further consideration.
3.	Redevelopment is an opportunity to improve water quality and habitats by reducing nutrient pollution and the impacts of impervious surface cover.
Recommendations	
1.	The Task Force supports the stormwater management findings of the Infill and Residential Study and urges implementation of its recommendations.
2.	Ensure that frequency of County inspections is sufficient to enforce the Erosion and Sediment Control Ordinance.

6. Onsite Sewage Disposal

a) Maintenance and Management of Onsite Sewage Disposal Systems/Alternative Wastewater Treatment Systems

Approximately 22.8 million gallons of raw or partially treated sewage from more than 30,000 homes is discharged into Fairfax County soils daily. It is estimated that at least 17%, or 3.8 million gallons, is discharged into the soils of the Occoquan Watershed. Properly designed, installed, and maintained onsite sewage disposal systems are unlikely to present adverse effects to the Occoquan Reservoir. However, systems that are improperly designed, improperly installed, and poorly maintained are likely to have limited life spans, eventually resulting in system failure and presenting potential adverse impacts on the Watershed.

Fairfax County's onsite sewage disposal systems are regulated at the State level by the Virginia Sewage Handling & Disposal Regulations and the Virginia Alternative Discharging Systems Regulations, and at the County level by Chapter 68 of the Fairfax County Code and the Chesapeake Bay Preservation Ordinance. The County does have enabling authority to adopt local regulations that are more restrictive than the State regulations.

Fairfax County is one of only a few counties to require permits for all repairs of septic systems. In Fiscal Year 2001, 1,042 onsite septic systems were evaluated

for system repair as a result of referrals and complaints County-wide. Of these evaluations, 891 repair permits were issued for repair or replacement of mechanical components, with only 1.3% of the permits requiring complete replacement of failed septic systems. Statistics specifically for the Occoquan Watershed are not available.

There is an increasing trend in the development community to request the use of technologically advanced, high maintenance alternative onsite sewage disposal systems in order to develop lots and parcels with marginal to poor soil conditions. Marginal soils and poor percolation no longer impede development of properties, thus allowing for potential development of lots previously determined to be "non-buildable" because of a lack of sewage disposal by traditional means. One hundred nineteen (119) permits for installation of alternative systems (with another 14 permits pending) have been issued in the past five years in Fairfax County. In the prior five-year period, only 18 permits were issued for alternative onsite sewage disposal systems. Technology has advanced more quickly than codes, regulations, or the maintenance industry. Some types of alternative systems, because of their shallow installations, are more prone to damage by lawn irrigation systems, lawn tractors, and other yard work. These systems include large numbers of mechanical components, which also increases the potential for malfunction. The eventual owners of the properties with such systems are usually unaware of the high maintenance requirements. Many of the technologically advanced individual alternative onsite sewage disposal systems are designed and operated much as a mini sewage treatment plant, with a discharge of treated effluent into a waterway, into a sub-soil disposal system, or spray irrigated onto the ground surface.

Most alternative systems have intensive maintenance requirements. Failure to maintain and properly manage these systems can lead to premature, catastrophic failure. Although onsite sewage disposal systems are required by County Code to have preventative maintenance, enforcement is largely gained by voluntary compliance. The Chesapeake Bay Preservation Ordinance requires that all septic tanks be regularly maintained. Therefore, the Health Department sends written notification for septic tank pump out and turning of flow diversion valves to affected properties. Septic tank pump out letters are sent to properties every five years. Notification to turn flow diversion valves is sent annually. Approximately 8,000 septic tanks were pumped last year, or about 1/5 of all tanks. Failure to maintain a septic system is a violation of the County Code and enforceable as a criminal offense. In severe cases, the Health Department may initiate legal action through the court system. The County currently only has the authority to perform routine septic tank pump-out for system maintenance and back-charge the property owner after notification is made to the owner to have the maintenance performed. Unless there is an actual demonstrated health hazard present on a property, the County does not have the authority to perform other necessary system maintenance and back-charge the property owner if the owner refuses to properly maintain the system.

Upon request, the Health Department provides presentations concerning onsite sewage disposal systems and their management to interested parties. Sewage disposal information programs have been broadcast on Government Access Channel 16. Video copies of septic systems programs are available in Fairfax

County libraries. Written pamphlets are available to the general public via request to the Health Department. The Health Department will be working to update existing written materials and include additional information on its web site. The Health Department is also working to identify and target specific potential "stakeholder" audience populations such as property owners, homeowners associations, builders, developers, real estate agencies, and mortgage lenders as a public education outreach effort to inform interested parties about the importance of proper septic system maintenance.

b) Future Concerns

Onsite sewage disposal systems are the sewage treatment and disposal solution for over 30,000 households without access to public sewer in Fairfax County. Even with proper maintenance, septic systems will ultimately require rehabilitation or replacement. However, a lack of appropriate monitoring and maintenance leads to premature system failure. Failures lead to loss of real property values, environmental degradation, and increased risk of water and vector borne disease. Furthermore, it can cost up to $40,000 to repair or replace a failing system. Suitable sites for structures to be served by traditional onsite sewage disposal systems are diminishing and the existing population of onsite sewage disposal systems is aging. The introduction of technologically sophisticated systems has allowed for the construction of increasing numbers of structures on sites that were previously non-buildable utilizing traditional onsite sewage disposal methods. A drawback of sophisticated sewage systems is the increased maintenance and monitoring requirements. Because of the aging population of existing systems and the introduction of high maintenance wastewater treatment and disposal technologies, the need for reliable maintenance service for these systems is expanding rapidly.

All septic systems require periodic maintenance. Rapid technological advancements in onsite wastewater treatment system design have left most service companies without the expertise to provide monitoring and maintenance services to system owners. A small monitoring and maintenance industry exists; however, the onsite sewage disposal maintenance industry is largely undeveloped and unregulated. No minimum credentials or certifications are required to provide monitoring or maintenance for septic systems.

Regionally, 22 companies with specific abilities provide septic tank pump out service for onsite septic systems. Of these 22 companies, one holds 35% of the market share. As technology has advanced to provide more sophisticated and complex onsite sewage disposal systems, the scope and skills of these companies have not advanced. Only three small companies provide limited services for technologically advanced systems. Of these three service providers, one holds 90% of the market share. These companies do not offer services to maintain or monitor the less complex systems. Currently, there is no referral service to match the needs of system owner with the services offered by private companies.

A private sector niche market should develop around the need and demand for management of onsite sewage disposal systems, and competition within the industry is expected to increase once existing service providers and sewage

system installation contractors recognize the rise in numbers of systems requiring increased maintenance. The specific time frame for development of this industry sector is unknown and may be long term.

The maintenance issues associated with onsite sewage disposal systems are not unique to Fairfax County. This is a national issue that is coming to the forefront as technologies in onsite wastewater treatment are developed and utilized. The U.S. Environmental Protection Agency (EPA), in the Draft EPA Guidelines for Management of Onsite/Decentralized Wastewater Management Systems, describes five separate model management programs presented as a progressive series in which the management requirements become more rigorous as the system technologies become more complex and/or as the sensitivity of the environment increases. There are many case studies available demonstrating the success of such management programs. The EPA program levels are:

- Model Program Level 1: The objectives are (1) to ensure that all onsite sewage disposal systems are sited, designed and constructed in compliance with state and local regulations and (2) to ensure that homeowners are informed of maintenance needs of the systems.

- Model Program Level 2: The objective is to ensure that maintenance contracts with trained operators are maintained by property owners where more complex and maintenance-intensive system designs are used.

- Model Program Level 3: The objective is to ensure that onsite systems continually meet the prescribed performance standards where systems are designed to meet specific effluent requirements.

- Model Program Level 4: The objective is to achieve continuous monitoring and reliable operation and maintenance of onsite systems by issuing an operating permit to a utility or "authority" instead of the property owner.

- Model Program Level 5: This model is a variation of Level 4, except that ownership of the onsite systems is no longer with the property owners.

ONSITE SEWAGE DISPOSAL FINDINGS AND RECOMMENDATIONS

Findings

1.	Inadequate maintenance of on-site sewage disposal systems by property owners, failure of septic systems that have outlived their life expectancy, and the aging population of existing on site sewage systems pose a growing potential for nonpoint source contamination of streams and the Reservoir.

ONSITE SEWAGE DISPOSAL FINDINGS AND RECOMMENDATIONS

2.	Emerging technology in the field of onsite sewage disposal can produce better quality sewage effluent for disposal, if properly maintained, but may also allow for construction on lands previously deemed as non-buildable properties due to marginal or poor soil conditions that will not support a conventional septic tank and drain field. Current policy does not encourage the use of higher technology sewage disposal systems because of the intensive maintenance requirements of these systems.
3.	The present level of regulation of onsite sewage disposal systems in Fairfax County relies heavily upon voluntary homeowner compliance and is insufficient to enforce preventative maintenance. Enforcement action, if necessary, is typically initiated upon presentation of a health hazard due to a failed system.
4.	No mechanism exists for routine inspection of existing onsite septic systems. Inspections of systems are only initiated through homeowners' self reporting of problems, complaints, and voluntary evaluations for real estate property transfers.
5.	Technologically advanced systems utilizing innovative disposal methods are fragile and require frequent maintenance. There are very few qualified maintenance service providers available at present, and property owners have no way of identifying these companies.
6.	Fairfax County is currently operating consistent with the U.S. EPA Model Program Level 3 through the enforcement of State and local regulations governing onsite sewage disposal. However, effective onsite sewage disposal system management is the key to ensuring that the requisite level of environmental and public health protection is achieved. It is the single most important factor in any comprehensive onsite sewage disposal management program. Without effective management, even the most costly and advanced technologies will fail to perform as designed, and efforts to protect public health and the environment will be compromised.

Recommendations

1.	Establish a Commission to investigate necessary legislation and ordinances to establish a self-supporting "Onsite Sewage Disposal System Management Authority" to move Fairfax County and potentially the region into the EPA Model Program Level 4. Invite participation by appropriate representatives from other Watershed jurisdictions. The Commission should be sensitive to the existing private septic haulers and should include them as an integral part of a management program. The "Authority" is envisioned to be structured similar to a utility that may be public, private or a public-private partnership. The "Authority" would perform routine maintenance and provide regular monitoring of all onsite systems. The system owners would pay a recurring fee to the "Authority" for routine maintenance and regular monitoring of the onsite sewage disposal systems by qualified professionals. The existence of an "Authority" would guarantee continuing preventative maintenance and would encourage the increased use of technologically advanced systems on lots and parcels with marginal to poor soil conditions. This would also allow those properties to be developed without creating future liabilities to the County due to failed onsite sewage disposal systems. Creation of an "Authority" would require the following:

ONSITE SEWAGE DISPOSAL FINDINGS AND RECOMMENDATIONS	
	• Identify and benchmark "Management Authorities" that may already be in place in other areas; • Research how "Management Authorities" are funded; • Research the need for legislation and/or local ordinances and prepare necessary legislation or ordinances; • Determine steps necessary to create and implement the "Management Authority; and, • Determine service levels necessary for different types of systems.

VI. WATERSHED STEWARDSHIP

The residents living within the Occoquan Watershed have a variety of programs available to them that can provide an introduction to their watershed community. Citizens can play a key supporting role as the County continues its watershed management planning and stream mapping efforts. As stakeholders, their support is critical to the successful development and implementation of County Watershed Management Plans. Citizens can also be stewards of the Occoquan Watershed in and near their communities not only by participating in organized programs but also by being informed of the principles of good stewardship and taking actions to ensure the Watershed's protection.

A. Citizen Education

Watershed education can change people's behavior toward protection of the Watershed. Many people who get involved will more likely contact County offices with questions about whom to call when they see dumping or inappropriate environmental activities. However, although there are many opportunities for citizen involvement, average citizens rarely attend meetings unless they have a personal interest. Outreach to the average citizen can happen through a variety of approaches, including both one-time and on-going programs.

1. Education about watersheds and water quality is critically needed. According to a national poll, only about 40% of those surveyed could define a watershed. A Chesapeake Bay Foundation poll found that few Bay watershed residents believed that their activities have any impact on water quality. Personal behaviors, such as lawn and garden care techniques, horse farm operations, vehicle maintenance and transportation mode choices, have a significant impact on water as well as air quality.

2. County staff and various organizations sponsor and co-sponsor seminars and workshops on topics related to stewardship of environmental resources. The participants in these educational programs become partners in protecting the resources and in turn teach others to participate in natural resource protection.

3. The Northern Virginia Soil and Water conservation District provides the following educational programs:

    - Teaching horse farm owners about development of conservation plans to prevent pollution of streams on and near their properties;
    - Educating and assisting landowners with soil erosion and drainage problems, pond maintenance, stormwater management, and stream stabilization;
    - Providing an educational manual, "You and Your Land," to citizens;
    - Selling seedlings with information about the value of trees in filtering rainwater and preventing erosion and sedimentation of streams;
    - Educating the public on the importance of protecting the Chesapeake Bay with storm drain stenciling programs noting the drains are for stormwater only;
    - Providing onsite education through watershed walks;
    - Providing programs for K-12 and college students and teachers about the importance of conservation; and,
    - Providing tours of water and sewage treatment plants to educate citizens about the origin and destination of water.

4. The Audubon Naturalist Society offers a number of programs to educate residents about water quality, such as:

    - *Explore Your Local Stream* walks to acquaint residents with local streams as living systems; these walks are usually conducted in partnership with other organizations and County agencies.
    - *Living Waters* slideshow presentations to civic associations, schools, and other groups interested in learning about stream ecosystems and water quality issues.
    - Water quality workshops for teachers and stream ecology programs for students and youth groups.
    - Interpretive signage at the Webb Sanctuary in Clifton explaining how land can be managed to enhance water quality.

5. In addition to offering County residents the opportunity to take a direct role in protecting the Occoquan Watershed by placing their property under a conservation easement, the Northern Virginia Conservation Trust provides watershed education and stewardship opportunities such as naturalist-led canoe trips, hikes, tree plantings, and invasive exotic species removal.

B. Citizen Volunteers

There are a number of programs in the County providing opportunities for volunteers, sponsored by both public agencies and non-profit organizations, which involve citizens in protecting sensitive environmental areas.

1. Stream Monitoring Program: The Northern Virginia Soil and Water Conservation District (NVSWCD) and the Audubon Naturalist Society sponsor and coordinate a stream monitoring program that educates citizens about watersheds, explaining basic concepts and teaching people how to monitor the health of streams. They provide training, equipment, quality control and communication. The NVSWCD program involves about 150 active volunteers who monitor about 45 sites, including the Cub Run, Sandy Run, Johnny Moore Creek, and Little Rocky Run sub

watersheds and Bull Run in the Occoquan Watershed. Other organizations in the County are also involved in volunteer monitoring. Volunteer monitoring is a crucial source of reliable and relatively inexpensive water quality data. While Fairfax County has staff focused on stream issues, there are not enough staff to monitor all streams regularly. The County's Stream Protection Strategies Baseline Study provided an excellent snapshot of our streams, but data gathered by volunteers provide on-going trend information.

2. "Friends" Groups: The Fairfax County Park Authority has a number of programs involving the community, both as volunteers and as students of the environment. There are a number of "friends" groups throughout the County, one of which is in the Occoquan Watershed - Friends of Little Rocky Run. While these groups are not monitoring streams scientifically, they protect their streams and waters by being vigilant about the condition of stream valleys, bank erosion problems, sedimentation, etc., and by endeavoring to protect these sensitive environmental areas.

3. Parks Volunteers: The Park Authority also has an active program of about 150 volunteers who serve at parks throughout the County and help with education, maintenance, and enhancement programs. The Park Authority also sponsors a number of educational programs on numerous topics related to all aspects of the natural environment.

4. Citizen Advocacy Groups: There are also many citizen advocacy groups and organizations that are involved to some degree with the protection of the Occoquan Watershed. Activities include advocating for environmental stewardship to attempting to influence County policies on land use and the environment. Examples of Occoquan-specific organizations include the Occoquan Watershed Coalition and the Friends of the Occoquan, while examples of more broad-based organizations include the League of Women Voters, the Fairfax County Federation of Civic Associations, the Western Fairfax County Citizens Association, and many, many others.

Communication is the key to a successful program. For citizens to feel vested in a program, it is necessary to communicate with them regularly and to give them volunteer options, such as a choice of days and times to work. They must see that a program is vibrant. For example, the NVSWCD communicates continuously using a variety of tools, including two web pages, one hosted through Fairfax County that provides basic information about the program and another that provides detailed information. The NVSWCD also has newsletters and, most importantly, frequent e-mail updates.

Attracting citizens to the importance of watershed protection and participation in this effort can be accomplished through press releases, community newsletters, meetings, festivals, and word of mouth, the last being the most successful. It is important to offer citizens a variety of programs and various options for participation. In general, citizens are truly concerned about their natural environment. As an expression of this concern, it is not difficult to attract their participation in hands-on environmental programs. However, it is essential that citizen volunteers see that their efforts lead to accomplishments, such as their stream monitoring data being utilized in a meaningful way.

C. Citizen Roles in Reporting and Enforcement

Citizens have always had a role in reporting environmental problems and identifying enforcement issues for follow-up by County staff. Whether it is an individual reporting sediment-laden stormwater coming from a construction site, or a community group banding together on a specific issue, citizens have long helped to enforce County ordinances.

The potential to expand citizen roles in environmental enforcement as a way of stretching County staff resources and strengthening environmental protection is a concept that is worth exploring and not without precedent. In 1999, a Neighborhood Volunteer Program was piloted in the Richmond Highway corridor in response to growing signs of property deterioration and blight. Recognizing the potential for citizens to play a role in code enforcement, County inspectors (Health, Zoning, and Public Works and Environmental Services) trained citizen volunteers to visually identify code violations. The volunteers would write a letter to a property owner requesting that the violations be corrected. At a designated time, the volunteers would return to the site to check if violations were corrected. As a result of the program, code violations achieved voluntary compliance over 85% of the time. The remainder of the violations were turned over to County staff for enforcement. In addition to increasing the County's ability to enforce its ordinances, the program also created a heightened sense of awareness that likely prevented violations from occurring in the first place.

The Neighborhood Volunteer Program is only one example of an existing program that could be applied to water quality protection in the Occoquan Watershed and County-wide. Examples of ordinances that could benefit from citizen involvement include the Chesapeake Bay Preservation Ordinance (encroachments into Resource Protection Areas) and the Erosion and Sediment Control Ordinance (insufficient or non-existent controls). While the Task Force had insufficient time to make specific recommendation with respect to enhancing the role of citizens in enforcing these regulations, it is an area that deserves further exploration.

CITIZEN INVOLVEMENT
FINDINGS AND RECOMMENDATIONS

Findings	
1.	Citizen education about the impact of personal behaviors on water quality is critically needed.
2.	Citizen and community involvement are critical to helping protect water quality and habitats in the Occoquan Reservoir and Watershed, as well as throughout the County.
3.	Regular communication with interested citizens, groups and organizations is essential to keep them informed and interested in participating in volunteer projects and ongoing programs.
4.	An effective outreach program for citizens requires a variety of venues and opportunities for involvement.
5.	Community and citizen participants in voluntary programs must see that their efforts produce accomplishments, i.e., their work is useful and their work product is used – and appreciated.

CITIZEN INVOLVEMENT FINDINGS AND RECOMMENDATIONS	
6.	Citizens play an important role in helping the County to enforce water quality ordinances that could be expanded to stretch limited staff resources.
Recommendations	
1.	The County should strengthen partnerships with appropriate public and citizen organizations to broaden participation in education and stewardship activities aimed at changing attitudes and behaviors. The mass media may be helpful in this effort.
2.	The County should encourage growth of the network of organizations and citizen groups concerned with and/or actively involved in watershed and water quality issues, and seek assistance on methods of reaching more citizens to seek participation in stewardship activities.
3.	The County should sponsor or become partners to sponsor more programs, meetings, seminars and festivals on water quality and natural resource protection that attract people who may become active volunteers in existing or new programs and help to educate others on the value of good stewardship.
4.	The County should support in any way possible the expansion of existing outreach and education programs, such as those sponsored by the Northern Virginia Soil and Water Conservation District, the Audubon Naturalist Society, and the Fairfax County Park Authority.
5.	The County should investigate proactive outreach to property owners who have property in or abutting Resource Protection Areas (RPAs) and/or other stream valley areas. The County may use its GIS to identify these parcels and to deliver stream-specific information RPA responsibilities, stewardship, and easement opportunities.
6.	The County should develop a strategy for strengthening the role of citizens in code and ordinance enforcement. This task should be assigned to County agencies responsible for environmental code enforcement with input from environmental and community watershed stakeholder groups.

VII. REGIONAL COORDINATION

While the primary focus of the Task Force's work was on the Fairfax County portion of the Watershed, there was also an early and explicit recognition that Watershed protection would have been impossible without a larger regional effort. Without coordination, or the establishment of regional expectations, efforts in one locality can be undone by another. The major regional accomplishments have been the Occoquan Policy and the establishment of BMP requirements throughout the Watershed by individual jurisdictions. The primary public mechanisms for coordination are the Occoquan Policy Board and the Occoquan Basin Nonpoint Pollution Management Program, administered through what is now the Northern Virginia Regional Commission. The Occoquan Policy Board is presently undertaking a multi-year project to prepare a regional Watershed management plan. This can be a mechanism for achieving or implementing Task Force recommendations that are more regional in scope.

REGIONAL COORDINATION FINDINGS AND RECOMMENDATIONS

Findings	
1.	As Fairfax County represents only 17% of the entire Occoquan watershed, Reservoir water quality cannot be maintained without continued regional cooperation among the Watershed's local governments and authorities. This cooperation is fostered primarily through the Northern Virginia Regional Commission's Occoquan Basin Nonpoint Pollution Management Program Policy Board and Technical Advisory Committee.
Recommendations	
1.	The Task Force strongly endorses continued support of regional approaches to Occoquan Watershed protection. The Task Force recommends that the County request the Northern Virginia Regional Commission to develop a plan to address identified issues of greater than Fairfax County concern. One approach could be to incorporate recommendations and findings into NVRC's multi-year effort to develop a regional watershed management plan for the Occoquan.

VIII. SUMMARY AND CONCLUSIONS

As Fairfax County celebrates the 20th anniversary of the landmark decision by the Board of Supervisors to downzone nearly 41,000 acres of the Occoquan Watershed, it can also celebrate the success of that effort in protecting the Occoquan Reservoir. Today, the Reservoir is a reliable source of clean water, which along with the Potomac River, serves the needs of over 1.2 million Northern Virginians. While the implementation of the Upper Occoquan Sewage Authority (UOSA) Water Reclamation Facility resulted in significant water quality improvement, the 1982 downzoning and regional implementation of stormwater BMP requirements have maintained water quality in the Reservoir despite significant growth and development. According to the Occoquan Watershed Monitoring Lab (OWML), water quality in the Reservoir has remained stable or has slightly improved since 1978 when UOSA went on-line. During the same time period, population in the entire Watershed (including the counties of Prince William, Loudoun, and Fauquier, and the cities of Manassas and Manassas Park) nearly tripled.

This success can be attributed to the efforts of many local, regional, and State government agencies that play a role in Reservoir protection, as well as the vigilance of community and environmental organizations and a host of individual concerned citizens. The Board of Supervisors recognized these stewards of the Reservoir and Watershed at a ceremony on July 22, 2002.

Despite the County's enormous accomplishments, there is more work to be done. Through research, monitoring, and modeling, the County now has a better understanding of the science of water quality protection and what it will take to ensure that the Reservoir continues to serve future generations of Northern Virginians. New State and federal mandates and programs, such as the Clean Water Act Total Maximum Daily Load requirements and Virginia's Tributary Strategies, will continue to push Reservoir management in new and ambitious directions. The Reservoir remains nutrient enriched. While this can in part be attributed to naturally occurring conditions, the County should continue to seek ways to reduce anthropogenic sources of

nutrient pollution. Finally, as development continues, non-traditional pollutants and spilling and dumping also have the potential to threaten Reservoir water quality.

The agencies charged to implement the County's original Reservoir protection strategy are now rising to address these new challenges. The Fairfax County Water Authority, the Occoquan Watershed Monitoring Lab, and the Upper Occoquan Sewage Authority have created an interagency Global Strategy Initiative to address emerging health related issues in the water treatment industry such as pathogens and endocrine disrupting chemicals. The Fairfax County Water Authority's newly completed Source Water Assessment identifies potential sources of contamination including hazardous material sites, land use, and other relevant data. On the policy side, the Northern Virginia Regional Commission is leading efforts to coordinate regional strategies to address new State and federal initiatives. All of these efforts are critical to the long-term protection of the Occoquan Reservoir and require the County's continued support.

Protecting the region's drinking water supply remains at the forefront of the County's concerns. However, it is increasingly recognized that the Watershed is much more than just a source of water for the Reservoir. In addition to being home to residents of the Centreville, Chantilly, Clifton, Pleasant Valley, Fairfax Station, Butts Corner, Westfields and Sully Station communities, the Watershed contains exceptional natural habitats and many of the County's recreational resources. Numerous streams run through the downzoned area of the Watershed. There are twenty-one Fairfax County parks in the Watershed and five regional parks, including Fountainhead, Hemlock Overlook, and Bull Run Marina.

As a result, much of the Task Force's discussions centered on the County's role in managing the Occoquan Watershed as a logical extension of Reservoir protection efforts. Fairfax County has already begun an aggressive County-wide watershed planning effort that will eventually lead to the development of watershed plans for each of the County's 30 subwatersheds. That effort began with the establishment of a Stream Protection Strategy (SPS) and the completion of an SPS Baseline Study in 2001 to document biological, chemical, physical, habitat, and flow regime conditions within the County's watersheds. The results of the SPS Baseline Study have provided critical insights into what has and hasn't worked with respect to the County's efforts to protect natural habitats and provided the Task Force with a launching point for investigating possible solutions to identified issues.

According to the SPS Baseline Study, many of the County's healthiest streams are located in the downzoned portion of the Occoquan Watershed. This can chiefly be attributed to the large-lot development pattern, which has served to maximize tree canopy and minimize impervious surface cover. However, the Baseline Study paints a much different picture of streams located outside the downzoned area. Many of these streams are considerably degraded, both in terms of habitat and physical appearance. The major questions faced by the Task Force then became: (1) how to best preserve the rich habitats within the downzoned portions of the Watershed; and, (2) how to prevent further degradation and restore streams outside the downzoned area.

While a majority of the land area in the downzoned portion of the Watershed is built out, according to County staff approximately 24% of the downzoned portion of the Watershed contains vacant or underutilized residential land. From a parcel-level standpoint, it is unlikely that any individual development project will significantly affect habitat or water quality. However, from a cumulative perspective, development potential within the downzoned area could have significant impacts. The Task Force has two primary concerns with respect to new development and redevelopment in the downzoned area of the Occoquan Watershed: (1) to minimize stream

impacts during the actual process of development; and (2) to minimize stream impacts after the development process is completed. The primary impact during development is erosion and sediment. The primary post-development impact is increased stormwater volume and velocity caused by the removal of tree canopy cover and the replacement of pervious surfaces with impervious surfaces (parking lots, rooftops, driveways, etc.).

With the exception of Special Permit and Special Exception uses, future development in the R-C District will be of a by-right character. This has implications for the mechanisms through which unregulated sensitive environmental areas can be protected, as there are limited opportunities to seek protection of such areas through the zoning process. The same is true for limiting the amount of impervious surface cover. However, there may be a need for the County to develop and implement performance requirements for by-right development in the R-C District, and these should be explored during the County's watershed management planning process.

In terms of the potential for the County to minimize the impacts of new development in the R-C District, the Task Force focused on Special Permit and Special Exception Uses. Special Permit and Special Exception uses approved in the R-C District have often been more intense in terms of impervious cover than conventional R-C District residential development allowed by-right. The Task Force found that with the exception of R-C District cluster subdivisions, there are not clear water quality based standards or guidelines (e.g., pollutant loadings, impervious cover, undisturbed open space protection) for Special Permit and Special Exception uses. This is an issue that needs to be addressed. As a result, among the Task Force's recommendations is that the Board of Supervisors should establish a broad-based advisory committee to make recommendations on guidelines and standards to be used with Special Permit, Special Exceptions, and public uses that may be considered in the R-C District.

While most of the area outside the R-C District in the Occoquan Watershed has been developed, according to County staff there are still over 3,300 acres of vacant land in this area. In addition, established communities in the Watershed are being redeveloped (e.g. the Rockland Village and Dix-Cen-Gato areas), and other developed areas of the Watershed may redevelop in the future. The focus of the Task Force was on how to prevent further degradation of already impaired streams, and to restore degraded streams where possible to support diverse aquatic habitats. Recommendations associated with preventing further degradation and promoting restoration are Watershed-wide (and indeed County-wide) in application.

As noted before, there is a direct correlation between stream health and impervious surface cover and tree canopy. There is also a direct correlation between adequate erosion and sediment control during development and stream health. Reducing the impacts of erosion and sediment on local streams is a County-wide issue and is addressed largely in the Infill and Residential Development Study accepted by the Board in 2001. The Task Force endorses the recommendations made in the Study and encourages their full implementation.

Minimizing impervious surface cover is critical to the protection of the County's streams. According to studies performed by the Center for Watershed Protection, watersheds with impervious surface cover of 10 to 15% will show clear signs of degradation, while watersheds with impervious surface cover greater than 25% typically do not support a diverse stream community. The Northern Virginia Regional Commission, which surveys land use in the Occoquan Watershed every five years, estimates Watershed-wide impervious cover of between 9 to 12%. As a result, how development in the Watershed is carried out in the next few years is critical to determining the long-term health of the Watershed's streams.

The County is already pursuing efforts to encourage low impact design (LID) techniques aimed at minimizing the impervious surface cover necessary for a specific land use. To the extent possible, voluntary implementation of LID should be supported and augmented through the County's Public Facilities Manual and other regulatory mechanisms.

Maintaining tree canopy cover is also critical to the protection of the County's streams. Loss of trees and forest stands in general can result in major changes to local hydrology, while loss of riparian forest buffers can significantly impact aquatic habitats. While the County possesses the authority to require tree replacement after development, it lacks comprehensive authority to require tree conservation. Gaining this authority is essential to allow the County to prohibit unnecessary clear-cutting during the development process. The Task Force recommends that the County continue to seek enabling authority from the General Assembly, as it has done in the past, to require that tree conservation be a part of tree canopy cover requirements. In addition, because tree canopy cover is integral to Reservoir water quality protection, the Task Force recommends that tree canopy goals for the Occoquan Watershed be developed and that appropriate implementation mechanisms for implementing these goals be identified.

A final water quality issue discussed by the Task Force is concern over the use of alternative wastewater treatment systems and the maintenance of onsite sewage disposal systems in general. According to County staff estimates, approximately 3.8 million gallons of sewage are treated by Watershed soils daily. Properly designed and maintained, these systems are unlikely to have adverse impacts on the Occoquan Reservoir. However, systems that are improperly designed, improperly installed, and/or poorly maintained are likely to have limited life spans, eventually resulting in system failure and presenting potential adverse impacts on the Watershed. Rapid technological advances in onsite wastewater treatment are also making it possible to build on lots in the Occoquan Watershed R-C District that only a few years before were thought to be undevelopable. While these systems can produce quality sewage effluent disposal, these advanced systems are fragile and require frequent maintenance. At present, there are very few qualified maintenance service providers and no certification process for ensuring that existing companies are qualified to perform the maintenance.

The maintenance issues associated with onsite disposal systems are not unique to Fairfax County, and the U.S. Environmental Protection Agency has developed guidance on how localities can better manage these systems. The Task Force recommends that the Board of Supervisors investigate whether to establish an "Onsite Sewage Disposal System Management Authority" to ensure that routine maintenance is performed on all systems and to ensure that implementation of advanced onsite systems does not create a future liability to the County.

Ultimately, no program or regulation at the County level will succeed without the participation of its citizens. Residents living in the Occoquan Watershed have a variety of programs available to them and the County should continue to promote, sponsor, and encourage these efforts. The County also should proactively engage citizens who live in or abutting Resource Protection Areas or other environmentally sensitive areas. For instance, the County could use its Geographic Information System (GIS) to identify these parcels and to deliver stream-specific information. The County should also explore the potential for citizens to become more involved in helping County staff enforce existing ordinances and regulations. Often, water quality problems are caused not so much by a lack of regulation but by a lack of staff resources to implement the regulations. The Task Force finds that this is particularly true in the case of enforcing the Erosion and Sediment Control Ordinance. The use of citizens as extended "eyes and ears" of County staff is not new, with one successful example being the Neighborhood Volunteer Program established in 1999 in response to growing signs of blight in the Richmond

Highway corridor. The County should develop strategies for strengthening the role of its citizens in enforcement.

Finally, while the primary focus of the Task Force's work was on the Fairfax County portion of the Watershed, it is explicitly recognized that Reservoir protection is impossible without the cooperation of the entire region. The County coordinates with its regional partners both on an individual basis and through the Northern Virginia Regional Commission's Occoquan Basin Nonpoint Pollution Management Program. The Task Force endorses the continued support of regional approaches and recommends that the County request NVRC to present the findings of the Task Force to the Program's Policy Board for incorporation into future work plans.

The following is a summary of the Task Force's recommendations. Many of these recommendations are endorsements of ongoing County efforts. However, the Task Force also makes specific recommendations designed to highlight emerging issues and to establish new mechanisms for addressing these issues. As such, this report is meant to serve as a launching point, rather than an end point. To ensure follow-through, the Task Force requests that the Board of Supervisors ask the County Executive to track and report to them on the implementation of Task Force recommendations at least annually.

Reservoir Recommendations	
1.	The Task Force strongly endorses existing programs and policies aimed at maintaining acceptable levels of water quality in the Reservoir. The County should oppose any effort to weaken regional policies, particularly the State's Occoquan Policy governing wastewater treatment.
2.	The County should strive to reduce nutrient and sediment contributions to the Reservoir above and beyond those being achieved through existing policies and ordinances.
3.	The County should continue to be an active participant in State and federal regulatory and/or policy initiatives that might result in requirements for additional nutrient and sediment reductions in order to ensure that reduction strategies are based on sound policy and science.
4.	The Task Force strongly endorses efforts such as the Global Strategy Initiative to predict and mitigate new pollutants of concern.
5.	The Task Force encourages the continued sharing and coordination of information among UOSA, OWML, and FCWA and County staff to ensure that Reservoir water quality concerns are appropriately addressed.
Streams and Ecosystems Recommendations	
1.	Rigorously maintain the integrity of the Occoquan downzoning. As demonstrated by the County's 2001 *Stream Protection Strategy Baseline Study*, the downzoning has been an effective measure for the protection of stream ecosystems.
2.	Continue regular long-term stream assessments by the Stream Protection Strategy staff. Such assessments are critical to measuring the County's progress in protecting and restoring stream ecosystems. These assessments should include continued partnership with volunteer stream monitoring efforts. The County should ensure that the Stream Protection Strategy staff is adequately funded and staffed to handle its growing responsibilities.

3.	Fully develop and implement the Stormwater Planning Division's watershed management planning process in the Occoquan Watershed, as well as all other County watersheds. This process represents the County's most focused and comprehensive approach to protecting and restoring stream ecosystems.
4.	Study and adopt new stormwater management designs that have been demonstrated to protect or improve the health of stream ecosystems.
5.	Encourage the use of those LID techniques that have been proven effective under local conditions, both where new development is planned and, to the extent feasible, for retrofitting of existing development. The County should further investigate the effectiveness and applicability of LID techniques.
Land Use and Open Space Recommendations	
1.	At a minimum, continue the County's commitment to the successful strategy for water quality protection of the Occoquan Reservoir that was established through the comprehensive zoning actions that were taken in 1982.
2.	Establish a broad-based advisory committee, to include stakeholders, County staff, and one or more members of the County's Planning Commission, to review standards and guidelines associated with Special Permit, Special Exception, and public uses that may be approved in the R-C District in the Occoquan Watershed and to report its findings and recommendations to the Board of Supervisors. The advisory committee should: • Review the maximum allowable floor area ratios currently allowed in the R-C District in light of overall impervious surface implications, public use/facility needs, institutional use needs, recreational needs, and the purpose and intent of the 1982 downzoning action. • Recommend zoning standards, performance standards, and/or Comprehensive Plan guidelines for total impervious cover and/or undisturbed open space. • Review the combined impact of the facility footprint and total impervious surface cover, including parking. • Determine if it would be appropriate to establish clearer guidance in the Comprehensive Plan regarding the circumstances under which Special Exception and Special Permit uses (as well as public uses reviewed during the 2232 process) can be considered to be "designed to mitigate impacts on the water quality of the Occoquan Reservoir."
3.	Establish a more proactive easements program that provides for outreach efforts to owners of land in the Occoquan Watershed that contains environmentally sensitive resources, particularly where these resources would not otherwise be protected by regulation.
4.	Fully fund watershed management planning efforts as well as the implementation of adopted plan measures. As part of the planning process: • Investigate the effectiveness of existing stream valley protection mechanisms. Identify additional regulatory and/or non-regulatory measures, if any, that may be needed in order to ensure that stream valleys will be protected adequately.

	• Identify additional performance requirements that may be appropriate to ensure that by-right development in the R-C District will not adversely affect stream quality.
5.	Complete the ongoing review of impediments to the application of low impact site design techniques and identify disincentives and policy/regulatory conflicts associated with the implementation of these techniques. Determine if and how these disincentives, impediments, and conflicts can be overcome so as to increase the application of such techniques in the Occoquan Watershed. Investigate incentives and requirements that could be pursued to increase the application of these practices.
Tree Preservation Recommendations	
1.	Continue to press for tree conservation and preservation enabling legislation.
2.	Establish tree canopy goals for the Occoquan Watershed and determine appropriate implementation measures for attaining those goals. Tree preservation, not removal and replacement, should be the primary means of achieving the goal.
3.	Encourage the revegetation of lost riparian stream buffers with native woody vegetation by identifying potential reforestation areas, providing citizen education, and encouraging citizen reforestation efforts.
Erosion and Sediment Control and Stormwater Management Recommendations	
1.	The Task Force supports the stormwater management findings of the Infill and Residential Study and urges implementation of its recommendations.
2.	Ensure that frequency of County inspections is sufficient to enforce the Erosion and Sediment Control Ordinance.
Onsite Sewage Disposal Recommendations	
1.	Establish a Commission to investigate necessary legislation and ordinances to establish a self-supporting "Onsite Sewage Disposal System Management Authority" to move Fairfax County and potentially the region into the EPA Model Program Level 4. Invite participation by appropriate representatives from other Watershed jurisdictions. The Commission should be sensitive to the existing private septic haulers and should include them as an integral part of a management program. The "Authority" is envisioned to be structured similar to a utility that may be public, private or a public-private partnership. The "Authority" would perform routine maintenance and provide regular monitoring of all onsite systems. The system owners would pay a recurring fee to the "Authority" for routine maintenance and regular monitoring of the onsite sewage disposal systems by qualified professionals. The existence of an "Authority" would guarantee continuing preventative maintenance and would encourage the increased use of technologically advanced systems on lots and parcels with marginal to poor soil conditions. This would also allow those properties to be developed without creating future liabilities to the County due to failed onsite sewage disposal systems. Creation of an "Authority" would require the following: • Identify and benchmark "Management Authorities" that may already be in place in other areas;

	• Research how "Management Authorities" are funded; • Research the need for legislation and/or local ordinances and prepare necessary legislation or ordinances; • Determine steps necessary to create and implement the "Management Authority; and, • Determine service levels necessary for different types of systems.
Citizen Involvement Recommendations	
1.	The County should strengthen partnerships with appropriate public and citizen organizations to broaden participation in education and stewardship activities aimed at changing attitudes and behaviors. The mass media may be helpful in this effort.
2.	The County should encourage growth of the network of organizations and citizen groups concerned with and/or actively involved in watershed and water quality issues, and seek assistance on methods of reaching more citizens to seek participation in stewardship activities.
3.	The County should sponsor or become partners to sponsor more programs, meetings, seminars and festivals on water quality and natural resource protection that attract people who may become active volunteers in existing or new programs and help to educate others on the value of good stewardship.
4.	The County should support in any way possible the expansion of existing outreach and education programs, such as those sponsored by the Northern Virginia Soil and Water Conservation District, the Audubon Naturalist Society, and the Fairfax County Park Authority.
5.	The County should investigate proactive outreach to property owners who have property in or abutting Resource Protection Areas (RPAs) and/or other stream valley areas. The County may use its GIS to identify these parcels and to deliver stream-specific information RPA responsibilities, stewardship, and easement opportunities.
6.	The County should develop a strategy for strengthening the role of citizens in code and ordinance enforcement. This task should be assigned to County agencies responsible for environmental code enforcement with input from environmental and community watershed stakeholder groups.
Regional Coordination Recommendations	
1.	The Task Force strongly endorses continued support of regional approaches to Occoquan Watershed protection. The Task Force recommends that the County request the Northern Virginia Regional Commission to develop a plan to address identified issues of greater than Fairfax County concern. One approach could be to incorporate recommendations and findings into NVRC's multi-year effort to develop a regional watershed management plan for the Occoquan.
Implementation and Reporting	
1.	To ensure follow-through, the Task Force requests that the Board of Supervisors ask the County Executive to track and report to them on the implementation of Task Force recommendations at least annually.

APPENDICES

Appendices

TASK FORCE MEMBERS AND PRESENTERS
APPENDIX A

Task Force Members

Members	**Agency/Organization**
Kambiz Agazi	Fairfax County Environmental Coordinator, County Executive's Office
Jeanne Bailey	Public Affairs Officer, Fairfax County Water Authority
Jeff Blackford	Deputy Director, Office of Site Development Services Department of Public Works and Environmental Services
Carl Bouchard	Director, Stormwater Planning Division Department of Public Works and Environmental Services
David Bulova, Co-Chair	Former Director of Environmental Services, Northern Virginia Regional Commission (NVRC)
Cliff Fairweather	Director, Webb Sanctuary, Audubon Naturalist Society (ANS)
Judith Heisinger	Sully District Appointee, President, Bull Run Civic Association
Irish Grandfield	Planning Section Supervisor, Fairfax County Park Authority
Dr. Tom Grizzard	Director, Occoquan Watershed Monitoring Lab (OWML)
Dennis Hill	Director of Environmental Health, Fairfax County Health Department
Maya Huber	Fairfax County Federation of Citizens Associations
Noel Kaplan	Environmental and Development Review Branch Department of Planning and Zoning
Dr. Evelyn Mahieu	Upper Occoquan Sewage Authority (UOSA)
Mary Nightlinger	Northern Virginia Soil and Water Conservation District (NVSWD)
Peyton Onks	Staff, Supervisor Elaine McConnell
Jean Packard	Braddock District Appointee Former Chairman, Fairfax County Board of Supervisors, NVSWCD
Merrily Pierce	Office of the Chairman, Fairfax County Board of Supervisors
Michael Riesenman	Manager, Occoquan Regional Park, Northern Virginia Regional Park Authority (NVRPA)
Leslie Vandivere	League of Women Voters of the Fairfax Area
Dr. David Schnare, Co-Chair	Occoquan Watershed Coalition
Alex Vanegas	President, Friends of the Occoquan
Other Participants	**Agency/Organization**
Normand Goulet	Northern Virginia Regional Commission
Sally Ormsby	Fairfax County Federation of Citizens Associations

Task Force Presenters

Robert L. Howell, Former Assistant County Attorney
David Bulova, Northern Virginia Regional Commission
David Schnare, Occoquan Watershed Coalition
Jeanne Bailey, Fairfax County Water Authority
Tom Grizzard, Occoquan Watershed Monitoring Lab
Laura Grape, Fairfax County Department of Public Works and Environmental Services
Cliff Fairweather, Audubon Naturalist Society, Webb Sanctuary
Noel Kaplan, Fairfax County Department of Planning and Zoning
Irish Grandfield, Fairfax County Park Authority
Jeff Blackford, Fairfax County Department of Public Works and Environmental Services
Dennis Hill, Fairfax County Health Department
Joanna Arciszewsi, Northern Virginia Soil and Water Conservation District

BOARD OF SUPERVISORS RECORD

(Approval of 20th Anniversary "Year of the Occoquan," authorization and appointment of New Millennium Occoquan Watershed Task Force and Study, and Board presentation of Proclamation and certificates)

APPENDIX B

CLERK'S BOARD SUMMARY
REPORT OF ACTIONS OF THE
FAIRFAX COUNTY BOARD OF SUPERVISORS
MONDAY
VIII. March 18, 2002

47. **OCCOQUAN WATERSHED YEAR** (Tape 5)

(BACs) Chairman Hanley stated that this year marks the twentieth anniversary of the Board's decision to downzone approximately 41,000 of the 63,000 acres (about 63 percent) of the land comprising the Occoquan Basin portion of Fairfax County. The action occurred on July 26, 1982. She noted that there was also an upzoning of a portion of the land within the basin. The purpose of the downzoning was the recognized need to protect the viability of the Occoquan River and its watershed that now supplies more than a million residents with their water. The County's Baseline 2000 Stream Protection Strategy Study found the County's healthiest streams in the Occoquan Watershed and as of March 14, 2002, the Occoquan Reservoir was 88 percent full, despite record low rainfall. She noted how the nation has become more aware of the need for protection and preservation of water supplies.

In recognition of the foresight of the Board, Chairman Hanley moved that the Board:

- Designate 2002 as "*Occoquan Watershed Year*" in celebration of the downzoning decision.
- Approve a proclamation recognizing the decision to be framed and posted in the Atrium of the Government Center.
- Approve a presentation before the Board of Supervisors honoring those who were instrumental in realizing the vision.
- Approve a presentation of certificates recognizing those groups that have been and continue to be stewards of the watershed.
- Approve a display at the Fairfax Fair in June, with County agency participation, that documents the decision and its benefits to the watershed.
- Approve the establishment of the New Millennium Occoquan Watershed Task Force to examine the impacts of increasing population, stormwater management, and other challenges in the watershed and to present its findings and recommendations to the Board. The task force should include representatives from appropriate County agencies, the Park Authority, Northern Virginia Soil and Water Conservation District, Northern Virginia Regional Commission, Northern Virginia Regional Park Authority, the Occoquan Watershed Coalition, Audubon Naturalist organization, Health Department, and stakeholder representatives.

- Approve the designation of the Office of Public Affairs to assist in coordination of events associated with the fair and other events that might be held during the rest of the year celebrating the event in the Occoquan Watershed.
- Approve a web page on the County's website dedicated to educating the public about the decision.
- Approve the coordination with the schools in that part of the County to provide educational materials on the Occoquan Watershed.

Supervisor Connolly and Supervisor McConnell jointly seconded the motion.
Supervisor Connolly asked unanimous consent that the Board direct staff to prepare a fact sheet as part of this effort. He said that the downzoning action should be put in context for citizens to understand the impact as to what was averted and a comparison with neighboring jurisdictions and their efforts. Without objection, it was so ordered.
Following discussion, the question was called on the motion, which carried by a vote of nine, Supervisor Mendelsohn not yet having arrived.

CLERK'S BOARD SUMMARY
REPORT OF ACTIONS OF THE
FAIRFAX COUNTY BOARD OF SUPERVISORS
MONDAY

June 3, 2002

ADDITIONAL BOARD MATTERS

25. **UPDATE ON THE OCCOQUAN WATERSHED YEAR ACTIVITIES** (Tape 4)
(BACs) Chairman Hanley referred the Board to a written update on the activities approved by the Board on March 18, 2002, in celebration of the twentieth anniversary of the decision to downzone part of the Occoquan Watershed to help protect the County's water supply. Displays will be in the tents of both the Department of Planning and Zoning and the Department of Public Works and Environmental Services during this weekend's Celebrate Fairfax festival and staff is preparing an informational brochure that will be available.
Chairman Hanley said that as part of the celebration, the Board will be honoring those members of County staff, other agencies, and community members who helped make that effort possible, as well as current stewards of the watershed. This will take place at the July 22, 2002, Board meeting, the date closest to the downzoning approval of July 26, 1982. There will also be a proclamation placed in the Atrium to commemorate the event.
Chairman Hanley stated that the Board approved the formation of a New Millennium Occoquan Watershed Task Force to look at current challenges and how the water quality can continue to be maintained. She distributed a list of the following representatives who had been appointed by their respective agencies/organizations to serve on that task force:

- Department of Planning and Zoning – Mr. Noel Kaplan
- Department of Public Works and Environmental Services – Mr. Jeff Blackford
- Fairfax County Health Department – Mr. Dennis Hill
- Fairfax County Park Authority – Mr. Irish Grandfield
- Fairfax County Water Authority – Ms. Jeanne M. Bailey

- Northern Virginia Regional Commission – Mr. David Bulova
- Northern Virginia Soil and Water Conservation District – Ms. Mary Nightlinger
- Northern Virginia Regional Park Authority – Mr. Mike Riesenman
- Upper Occoquan Sewer Authority – Dr. Evelyn Mahieu
- Audubon Naturalist Society (Webb Sanctuary) – Mr. Cliff Fairweather
- Occoquan Watershed Coalition – Dr. David Schnare
- League of Women Voters of the Fairfax Area – open
- Fairfax County Federation of Citizens Associations – Ms. Maya Huber
- Friends of the Occoquan – Mr. Alex Vanegas
- Supervisor Sharon Bulova – Ms. Jean Packard
- Supervisor Michael Frey – open
- Supervisor Elaine McConnell – open

Chairman Hanley relinquished the Chair to Vice-Chairman Hyland and asked unanimous consent that the Board request Mr. Al Akers of the Occoquan Watershed Coalition to chair the task force. Without objection, it was so ordered. A brief discussion ensued.

CLERK'S BOARD SUMMARY
REPORT OF ACTIONS OF THE
FAIRFAX COUNTY BOARD OF SUPERVISORS
MONDAY
IX. July 22, 2002

6. **PROCLAMATION DESIGNATING 2002 AS *"OCCOQUAN WATERSHED YEAR"* IN FAIRFAX COUNTY, AND CERTIFICATES OF RECOGNITION PRESENTED TO COUNTY STAFF, COUNTY AGENCIES, COMMUNITY MEMBERS, AND CURRENT STEWARDS OF THE OCCOQUAN WATERSHED** (Tapes 1-2)

Chairman Hanley relinquished the Chair to Vice-Chairman Hyland and moved approval of the Proclamation designating 2002 as *"Occoquan Watershed Year"* in Fairfax County. Supervisor Connolly and Supervisor Hudgins jointly seconded the motion.
Following a brief discussion, the question was called on the motion and it carried by unanimous vote.

Chairman Hanley presented Certificates of Recognition to the following County staff, County agencies, community members, and current stewards of the Occoquan Watershed on the twentieth anniversary of the decision to downzone part of the Occoquan Watershed to protect the water supply in Fairfax County:

1980 Occoquan Basin Study Citizens Task Force Members who supported the study:

- Maya Huber - Task Force Chairman and Fairfax County Federation of Citizens Associations' representative
- Dave Russell - Annandale District Representative
- Cress Malkerson - Centreville District Representative
- Barbara Nunes - League of Women Voters of the Fairfax Area Representative

- Jan Jeffries - widow of Norm Jeffries who was Tree Commission Representative
- Nancy Brown - Mason District Representative
- Ivy Mitchell - Springfield District Representative
- John Bean - Mount Vernon District Representative

County Organizations and their representatives at the time that served as Amici Curiae (Friends of the Court) for 1985 Court Case Upholding Board's 1985 Decision:

- Sally Ormsby - President, Fairfax County Federation of Citizens Association
- Mary Nightlinger - Chairman, Soil and Water Conservation District Board
- The Honorable Leslie Byrne - President, League of Women Voters of the Fairfax Area
- Fred Morin - Chairman, Fairfax County Water Authority Board
- Randolph Church - Attorney for the Friends of the Court
- John Epling - Director, Northern Virginia Planning District Commission
- The Environmental Defense Fund, Loudoun County, and VACo were also "friends of the court."

County staff who were instrumental in the initial decision and the subsequent court case:

- Theodore Wessel (Retired)
- Steve McGregor
- Bruce Douglas (Retires this week after 24 years with the County)
- David Stroh
- Jack White

County's Legal Defense Team that Defended the County in the 1985 Lawsuit:

- The Honorable David Stitt
- Robert Howell
- George Symanski
- J. Patrick Taves
- Robin Baxter
- Richard Tremaine
- Sid Steele - as Director of the former Office of Comprehensive Planning (now called the Department of Planning and Zoning) after the decision
- Lee Epstein of OCP (now called DPZ) who made significant contributions to the development of the legal strategy
- Audrey Moore - former Board of Supervisors Chair, and Member of Board in 1982 and 1985
- Special thanks to Johanna Fitzpatrick, presiding judge for the Fairfax County Circuit Court, now Chief Judge, Virginia Court of Appeals

Current Stewards of the Watershed:

- Al Akers - President, Occoquan Watershed Coalition
- Bill Cole - Vice President
- Jim Little - Secretary/Treasurer
- Eric Thiel - Transportation Committee Chair
- David Schnare - Chairman, Land Use and Environmental
- Cliff Fairweather - Director, Audubon Naturalist Society's Webb Sanctuary, Clifton, Virginia, and its four Stream Monitor Site Leaders: Brad Hunter, Charles Smith, Jenny Salom, and Neil Sullivan

- Alex Vanegas - President, Friends of the Occoquan, a stream clean-up team, Girl Scout Troop #2033, Service Unit 70-5 from Reston - Susan Funk, Leader)
- Joanna Arciszewski - Northern Virginia Soil and Water Conservation District's Watershed Specialist (Deanna Crumbling and Blythe Merritt - Team Leaders)
- Rowland Shep Oliver - Owner, Oliver Stables
- Ned Foster - President, Friends of Little Rocky Run
- Tom Grizzard - Director, Occoquan Watershed Monitoring Laboratory

Staff and related agencies that are currently involved in the Occoquan Watershed Issues:

- John Wesley White - Director, Department of Public Works and Environmental Services
- John Friedman, Office of Site Development Services, DPWES
- Fred Rose and the entire Stream Protection Strategy Team
- James Zook, Department of Planning and Zoning
- David Bobzien, County Attorney
- Department of Health
- Fairfax County Water Authority
- Northern Virginia Regional Commission
- Northern Virginia Soil and Water Conservation District
- Upper Occoquan Sewage Authority

Supervisor Frey noted that over the years the Western Fairfax County Citizens Association has contributed in helping to protect the Watershed in the Sully District.
Chairman Hanley noted that a representative from the Western Fairfax County Citizens Association will serve on the Task Force that has been established by the Board to look at the future of the Watershed.

Chairman Hanley recognized the presence of former Board Chairman Audrey Moore and warmly welcomed her. Mrs. Moore explained the history of the community campaign against a plan to install sewer in the Occoquan in the early 1970s and provided additional details about citizen and staff support for the 1985 court case.

Vice-Chairman Hyland returned the gavel to Chairman Hanley.

Appendix B

OCCOQUAN POLICY
APPENDIX C

VIRGINIA ADMINISTRATIVE CODE CHAPTER 410
OCCOQUAN POLICY (Originally Enacted July 1, 1972)

9VAC25-410-10. Introduction.

A. Purpose and authority. To provide a policy that protects the Occoquan watershed from point source pollution. The Occoquan Policy specifically regulates jurisdictional domestic sewage and sets forth requirements for high performance regional treatment plants. The policy was adopted pursuant to authority vested in the State Water Control Board (board) by §62.1-44.15 of the State Water Control Law.

B. Water quality standard. This "Occoquan Policy" also constitutes special standard "g" in the board's water quality standards for sections 7a, through 7h of the Potomac River Basin's Potomac River Subbasin (9VAC25-260-390), which sections are delineated geographically in the "Basin and Section Description" portion of the water quality standards publication (9VAC25-260-10 et seq.). In addition, the text of this policy is referred to under special standards and requirements (9VAC25-300-10), entitled "Occoquan Watershed Policy," of the water quality standards (9VAC25-260-10 et seq.).

C. Background. During the 1960s there was a great deal of concern generated about the large amount of treated sewage effluent being discharged in the Occoquan watershed, since the receiving streams feed the Occoquan reservoir, a drinking water supply for over 600,000 people in Northern Virginia.

In response to this, the board commissioned the firm of Metcalf & Eddy to study the problems of the Occoquan reservoir and to recommend a course of action to preserve the Occoquan as a valuable water resource for future generations.

The results of the Metcalf & Eddy study stated that point source pollution was the primary cause of water quality degradation in the Occoquan watershed and that a high degree of waste treatment would be necessary to prolong the life of the drinking water supply.

In 1971 the board adopted a policy for waste treatment and water quality management in the Occoquan watershed (the Occoquan Policy) which outlined a course of action to control point source pollution in the watershed.

The Occoquan Policy provided for the construction of regional high-performance treatment facilities in the watershed and a monitoring program to obtain water quality data both before and after construction of any of the high-performance plants.

The Occoquan Watershed Monitoring Program (OWMP or monitoring program) was established in 1972 which gathered an extensive amount of information and found that water quality problems in the Occoquan watershed were related directly to point source pollution and to non-point source pollution.

In 1978, a regional high-performance treatment facility (the Upper Occoquan Sewage Authority-UOSA) was placed in operation. This facility eliminated 11 major point sources of pollution in the watershed.

Shortly after UOSA began operations, costs and charges for sewage treatment in systems tributary to UOSA increased rather sharply. To date a significant part of those high costs have been associated with large amounts of infiltration and inflow being sent by the user jurisdictions to the regional facility for treatment.

In an attempt to control non-point source pollution the Commonwealth of Virginia adopted an erosion and sediment control law in 1973. In accordance with this law, all of the watershed jurisdictions have adopted

erosion and sediment control ordinances. In addition, a number of best management practices (BMP) handbooks were written and published in 1979 by the board. In mid-1980 Fairfax County adopted a BMP ordinance.

In 1978, the board contracted the firm of Camp Dresser & McKee (CDM) to reevaluate certain aspects of the Occoquan Policy. Their report was presented to the board and to the local communities in 1980 and recommended that few changes be made to the policy.

As a result of the CDM report, input from the local communities and the board's staff, an updated version of the Occoquan Policy was drafted.

D. References.

1. A Comprehensive Pollution Abatement Program for the Occoquan Watershed, Metcalf & Eddy Engineers, March 18, 1970.

2. Record of public hearing on March 31, 1971, concerning State Water Control Board's Occoquan Policy.

3. Occoquan Policy Reevaluation, Phase III Report, Camp Dresser & McKee, June 1980.

4. Record of public hearing on November 20, 1980, concerning amendments to the Occoquan Policy.

9VAC25-410-20. Long-range policy.

A. Number and general location of regional treatment plants.

1. The number of high-performance regional plants which shall be permitted in this watershed is not more than three, but preferably two, generally located as follows:

a. One plant in the Fauquier County/Warrenton area.

b. One plant in the Manassas area to serve the surrounding area in Prince William, Fairfax, and Loudoun counties.

2. All point source discharges of treated sewage effluent will preferably be located at least 20 stream miles above the Fairfax County Water Authority's raw water intake. In no case shall a plant be located less than 15 miles above the raw water intake.

3. The provisions of 9VAC25-410-20 A 1 and 2 shall not limit the consideration of land disposal systems for waste treatment in the watershed, provided such systems shall have no point source discharge to state waters and shall have the approval of the State Water Control Board.

B. Regional plant capacity allocations for the Occoquan basin.

1. The initial allotment of plant capacity for the Upper Occoquan Sewage Authority treatment facility was approximately 10 MGD, based on all effluent being from high-performance plants meeting the requirements of subsections D, E and F below and all those treatment facilities belonging to the City of Manassas, the City of Manassas Park, the Greater Manassas Sanitary District, and Sanitary District 12 of Fairfax County being abandoned.

2. Incremental increases in the regional plant capacity may be approved by the board based on the results of a monitoring program which shows that current and projected discharges from the high-performance plants do not create a water quality or public health problem in the reservoir. The board advises that since severe infiltration/inflow stresses the performance reliability of the regional treatment plants, jurisdictions must pursue I/I correction within their individual systems.

C. Prerequisites for preliminary plant approval. Prerequisites before the board gives approval to preliminary plans for a regional high-performance plant are:

1. A monitoring program for the receiving waters shall be in effect; and

2. The authority who is to operate the proposed plant shall enter into a written and signed agreement with the board that the authority shall meet the administrative requirements of subsection F of this section.

D. Design concept for high-performance plants on the Occoquan.

1. Plant design requirements are:

a. The design of the high-performance sewage treatment plants discharging to the Occoquan Watershed shall meet all the requirements specified here as well as those specified in the most recent edition of the Commonwealth of Virginia Sewerage Regulations; and

b. The basic sewage plant design concept for the regional plants discharging to the Occoquan watershed shall be based on the Upper Occoquan Sewage Authority Wastewater Reclamation Facility.

2. Changes in plant design requirements will be made according to these criteria:

a. Changes to the plant design described here shall only be acceptable if the change does all of the following:

(1) Improves or equals the plant performance and final effluent quality;

(2) Increases or equals plant reliability and maintainability; and

(3) Has a demonstrated performance in a plant of at least 5 to 10 MGD size for an operating period of not less than one, but preferably two years.

b. Before such changes are incorporated in the plant, specific written approval shall be obtained from the board; and

c. Changes to the plant design solely to reduce cost and which jeopardize plant performance and reliability will not be approved.

E. Plant performance requirements.

1. The plant performance requirements for high performance plants discharging to the Occoquan watershed are given in Table I.

2. Operation of the nitrogen removal facilities is required when the ambient nitrate concentration (as N) is 5.0 mg/l or higher in the Occoquan reservoir in the vicinity of the Fairfax County Water Authority intake point. The owner of the regional sewage authority is responsible for knowing ambient results of nitrate and when operation of nitrogen removal facilities is necessary.

TABLE I.
MINIMUM EFFLUENT QUALITY REQUIREMENTS* FOR ANY REGIONAL SEWAGE TREATMENT PLANT IN THE OCCOQUAN WATERSHED.

FINAL EFFLUENT REQUIREMENTS

COD mg/1 - 10.0

Suspended solids mg/1 - 1.0

Nitrogen mg/1 - 1.0**

Phosphorus mg/1 - 0.1

MBAS mg/1 - 0.1

Turbidity NTU - 0.5***

Coliform per 100 ml Sample - less than 2.0

* As measured on a monthly average unless otherwise noted. Since these are minimum requirements, the normal average would be expected to be substantially better.

** Unoxidized nitrogen (as TKN) Refer to 9VAC25-410-20 E 2 for further information.

*** Measured immediately prior to chlorination.

F. Administrative and technical requirements for the control of the sewer system tributary to a regional, high-performance plant in the Occoquan watershed.

1. The owner to whom the permit is issued for operation of a regional plant shall meet the general and administrative requirements covered below. These requirements shall also be contractually passed on by the owner to any parties or jurisdictions with which the owner may contract for the processing of wastewater.

These requirements are applicable to regional sewage treatment plants.

2. The high-performance regional treatment plant shall be manned by an appropriate number of trained and qualified operating, maintenance and laboratory personnel and manned continuously 24 hours a day, seven days a week throughout the year.

3. The owner shall include, as part of his preliminary and final plans and specifications submitted to the board for approval, a detailed statement indicating how each of the technical and administrative requirements in this policy has been met. Any proposed deviation from any of these requirements shall be clearly identified and technically justified, and shall require formal board approval. These submittals shall also include:

a. Simplified fluid system diagrams which clearly identify the following:

(1) The average and peak capacity of each unit;

(2) The number of units of each type needed to handle the normal average flow and the peak of flow; and

(3) The number of spare units and their capacity for both average and peak flow cases shall also be identified.

In addition, a brief narrative summary description shall be submitted to identify what has been done to ensure that each unit and major subsystem can be maintained and expanded without release of effluent that does not meet the minimum standards.

b. A simple one-line power distribution system diagram showing how outside power is brought into the plant and how power is distributed within the plant proper shall be submitted. This diagram shall also show as a minimum:

(1) Ratings and characteristics of electrical components such as transformers, circuit breakers, motor controllers, etc., making up the system;

(2) Protective devices such as thermal overloads, under frequency, or under voltage relays;

(3) Voltages supplied by all fuses;

(4) Normal circuit breaker and switch conditions (Notes shall also be provided as required to cover abnormal, casualty, and emergency operating modes); and

(5) How electrical loads are combined into switch gear and load center. (The use of cubicle outlines in phantom or dotted line is suggested.)

4. The final submittal of plans and specifications for the plant to the board shall include a systematic failure mode and effects analysis on the mechanical and electrical portions of the plant so as to demonstrate that a single failure of a mechanical or electrical component will not interrupt the plant operations which are necessary to meet the effluent requirements of Table I of this policy.

5. Pumping stations on the collection systems which are located in the Occoquan watershed and are tributary to a regional treatment works shall:

a. Have stand-by pumping units;

b. Have at least one "on-site" backup power supply;

c. Have at least one "off-site" power supply;

d. Be designed so that no single failure of a mechanical or electrical component could degrade pumping capability;

e. Have pumps and valves arranged so that these units can be removed and replaced without the by-passing of sewage;

f. Have flow measure devices with provisions for recording flow; and

g. Have retention basins of a minimum one-day capacity.

If these pumping stations are remote and unmanned, an alarm system shall be provided at manned stations to indicate that problems are developing and to direct maintenance assistance to the affected pumping station. The owner of each pumping station shall be required to obtain a State Water Control Board certificate.

A waiver may be sought from requirement g above, particularly in new collection systems exhibiting no I/I problems. However, the jurisdiction requesting such a waiver must submit documentation to the board for review that the sewer system tributary to the pump station meets the criteria established by the most recent edition of the Virginia Sewerage Regulations for infiltration/inflow, and any other such information that the board may require.

6. The major junctions in the collection system (e.g., at least at the 1 to 2 MGD collection points) shall have continuous recording flow measuring devices to help in the early identification of problem portions of a collection system in the event of unexplainable high flows (e.g., excessive infiltration). Also, such flow measuring devices and isolation valves shall be provided between jurisdictions as well as any others contracting for the services of the regional plant. The flow measuring devices and isolation valves between jurisdictions shall be under the control and responsibility of the owner to whom a plant certificate is issued.

7. Each sewage treatment plant shall have a pretreatment program approved by the board.

8. Waste being processed in any existing small plants shall have the first priority on treatment capacity and such capacity shall be specifically reserved for them in the new high-performance regional plants. New developments are to have second priority.

9. If any of the various administrative procedures of the owner of the regional treatment plant or of jurisdictions served by the plant prove ineffective under actual operating conditions, the board shall have the right to place new requirements on the owner and jurisdictions and to require any necessary action by these parties to physically correct the damage done to the reservoir due to ineffective implementation of the administrative requirements covered here.

10. The owner's interceptor and collection systems of the jurisdictions in the Occoquan watershed shall be designed, installed, inspected, and tested by the respective owner to limit infiltration to 100 gal/inch-dia/mile/day as a maximum. The test results shall be certified and submitted to the board.

11. Whenever the owner enters into an agreement with a jurisdiction for services of a regional plant, the owner shall be responsible for seeing that such jurisdictions have ordinances and rules to meet all the applicable requirements covered by this policy. These ordinances and rules shall meet the owner's approval and the owner shall monitor and spot-check to see that the jurisdictions are effectively implementing their ordinances and rules to meet the requirements covered here. The board, at its discretion, can request the owner to submit to the board for its approval the ordinances and rules that will be used to meet the board's requirements covered here.

Further, any time a user violates any of the administrative or technical requirements of the contract between the user and the owner which can affect the plant operations, hydraulic loading, or effluent quality or which affect the reservoir's water quality due to urban run-off (e.g., siltation), the owner shall not allow the user to discharge additional wastewater to the owner's plant until the problem has been resolved to the owner's satisfaction.

12. Up-to-date "as-built" drawings and manuals shall be available at least once a year for board inspection and review. These documents shall include as a minimum:

a. Up-to-date as-built electrical and fluid system diagrams;

b. Detailed as-built and installed drawings; and

c. Normal operating and casualty procedures manual. The documents shall be updated at least once a year to reflect all changes and modifications to the plant.

13. The design engineer shall have the responsibility of meeting the proposed effluent quality as shown in Table I. To demonstrate that the plant as designed by the engineer can meet the effluent standards, the plant is to be operated under the supervision of the design engineer for a minimum of one year of continuous operation after the "debugging" period.

G. Other point source discharges.

1. Point sources other than regional plants will be permitted as regulated or required by the Virginia Pollutant Discharge Elimination System (VPDES) permit regulation (9VAC25-30-10 et seq.).

2. VPDES permits may be issued for single family homes with failing septic tanks, stormwater, pollution remediation projects, and minor industries. The permitting of major discharges (as defined in 40 CFR Part 122) other than regional sewage treatment plants is strictly prohibited with the exception of pollution remediation projects which are shown to be feasible and no other alternatives are available.

3. No permit as authorized in subdivisions 1 and 2 above shall be issued or reissued unless the applicant demonstrates that it is not feasible to connect to a regional plant and that there is not a feasible alternative except to discharge.

9VAC25-410-30. Expansion of existing plants in the Occoquan watershed.

A. One of the objectives of the Occoquan Policy is to reduce water quality problems in the Occoquan watershed due to pollution from point sources. To date the means of accomplishing this objective have

been the construction and utilization of a high-performance regional plant - the Upper Occoquan Sewage Authority (UOSA) - and the elimination of 11 low-performance treatment plants in favor of the UOSA facility. The 11 low-performance treatment plants constituted the major point sources of pollution in the Occoquan Watershed; however, there are a number of smaller sewage treatment facilities which are still discharging. These facilities were not connected to the regional facility for at least one of the following reasons: (i) a collector system to the regional plant was not constructed in close enough proximity to provide service, or (ii) the small facility was outside of the service area for the regional plant. At some point in the future, these remaining plants may wish to expand and increase their flows.

B. Existing waste treatment facilities may be expanded to receive increased sewage flows; however, the degree of treatment must also be upgraded so that there will be no increase in the quantity of pollutant loadings discharged to the receiving stream. A no-discharge land-application system may be considered in lieu of upgrading a facility.

C. Plants not meeting approved design performance limits will not be allowed additional capacity until the owner has installed additional treatment and demonstrated by means of a minimum of three months of performance data that the plant has been brought within its approved design performance levels and can accept additional waste loads without exceeding such approved design performance levels.

D. No expansion or continued discharge shall be approved if it is feasible for the flow to be directed to a regional plant.

E. Proposed interim expansion of plants shall be reviewed with the appropriate regional sewage authority to assure that such expansions are coordinated with the authority regional plans and can be readily incorporated into the regional system.

F. The plans and specifications for expansion of collection and interceptor systems shall be reviewed with the appropriate regional sewage authority for its comments before they are submitted to the board and the Virginia Department of Health for approval. Any proposed expansion of collection and interceptor systems shall meet the technical and administrative requirements of 9VAC25-410-20 F, and the jurisdiction proposing such an expansion shall submit a formal letter to the board stating that its expansion will meet the requirements of 9VAC25-410-20 F.

9VAC25-410-40. Occoquan Watershed Monitoring Program (OWMP).

Due to the critical nature of the receiving waters, intensive monitoring will be required to ensure that plants achieve desired performance levels at all times, and the effects of point sources and nonpoint sources on the receiving waters are measured and projected.

1. Watershed monitoring subcommittee.

a. In order to ensure that performance levels are maintained and that the effects of point sources and nonpoint sources on receiving waters are known, a watershed monitoring subcommittee shall be established and shall be convened at least once each calendar year. A subcommittee of this type must necessarily be composed of high-caliber personnel knowledgeable in the field of water and wastewater treatment and management. Accordingly, the subcommittee shall consist of two ex-officio members or their designated representatives as follows:

(1) Director of Virginia Department of Health's Division of Water Programs;

(2) Director of Virginia Department of Conservation and Recreation's Division of Soil and Water Conservation; and three other members or their designated representatives as follows:

(a) A representative of the Environmental Protection Agency;

(b) A representative of a state university in Virginia; and

(c) A nationally recognized consultant in the water and wastewater treatment or water quality management fields.

b. The ex-officio members shall select and submit to the board for approval the names of the other members of the subcommittee. The subcommittee shall elect a chairman.

c. From time to time the subcommittee may seek additional expert advice.

2. Monitoring subcommittee's responsibilities. The watershed monitoring subcommittee shall have the following responsibilities:

a. To oversee that there is adequate monitoring of the regional plant effluent and process control testing at the regional plant;

b. To develop a water quality monitoring program for the Occoquan reservoir and its tributary streams to ensure that there is a continuous record of water quality available. To further ensure that projections are made to determine the effect of additional waste loading from point sources as well as nonpoint sources;

c. To ensure that the stream monitoring program is separate and distinct from plant process control testing and effluent monitoring;

d. To review data collected from the monitoring program and submit to the board and the various jurisdictions reports on the status of plant performance and water quality in the watershed at least once each year;

e. To report to the board immediately significant changes in plant performance or water quality due to either point source or non-point source pollution;

f. To maintain close liaison with the Fairfax County Water Authority in order to ensure satisfactory raw water which can be adequately treated at the authority's facilities; and

g. To establish the Occoquan Watershed Monitoring Laboratory (OWML) to conduct sampling and analyses to fulfill the above responsibilities.

3. Provision for restructuring of the OWMP.

a. The Occoquan Watershed Monitoring Program (OWMP) and the Occoquan Watershed Monitoring Laboratory (OWML) were established in accordance with the above provisions. This was done on July 1, 1972. Since that time a large body of information regarding the functioning of the Occoquan reservoir system has been accumulated. Major point sources have been consolidated into and eliminated by a high-performance sewage treatment facility (UOSA). As growth increases in the watershed, this trend is expected to continue.

b. The work performed by OWML has indicated that the key to water quality is a two part issue. Those parts are point source pollution and non-point source pollution. Point source discharges in the watershed are currently regulated by the board's VPDES permit program. Non-point sources of pollution are currently being addressed by state and local voluntary and mandatory control programs. However, in the future it may be necessary that additional mandatory programs be adopted.

c. The program shall be evaluated periodically for restructuring to account for shifts in monitoring trends and funding and any recommended restructuring approved by the board prior to implementation. The regional sewage plants are ultimately responsible for the monitoring program with the exception of the non-point source elements.

4. Financing the OWMP.

a. It is recommended that the cost of the OWMP be split equally between water supply and sewage uses. This would mean that the Fairfax County Water Authority would have to fund half of the OWMP budget while the counties of Fairfax, Prince William, Loudoun, and Fauquier and the cities of Manassas and Manassas Park would be responsible for jointly funding the other half. That portion of the OWMP budget funded by the counties and cities would be divided so that each jurisdiction would be charged in proportion to its allotted sewage capacity in the Occoquan watershed. The budget shall be reviewed by the jurisdictions prior to approval by the subcommittee.

b. Written agreements shall be obtained from each of the jurisdictions which shall commit them to supply the above funds yearly to finance the OWMP. This monitoring program is for their protection and benefit. If for some reason a county or city does not wish to retain its sewage allotment in the Occoquan watershed or will not fund the monitoring program, then its allotment can be divided up among the remaining participating jurisdictions, with their portion of the cost of the monitoring program rising accordingly. The regional sewage plants are ultimately responsible for monitoring with the exception of non-point source elements.

c. If federal funds and assistance can be obtained, the cost to the counties and the Fairfax County Water Authority will be reduced proportionally. The funding of the program without federal funds is to be assumed, so as not to further delay or complicate the initiation of this program.

d. The Office of Sponsored Programs, Virginia Polytechnic Institute and State University, has agreed to be responsible for billing, receiving, and disbursement of funds to the OWMP.

Appendix C

OCCOQUAN BASIN STUDY – EXECUTIVE SUMMARY
APPENDIX D

Appendix D

R-C DISTRICT AND WATER SUPPLY PROTECTION OVERLAY DISTRICT
APPENDIX E

ZONING ORDINANCE ARTICLE 3
RESIDENTIAL DISTRICT REGULATIONS
PART C 3-C00 R-C RESIDENTIAL-CONSERVATION DISTRICT

3-C01 Purpose and Intent

The R-C District is established to protect water courses, stream valleys, marshes, forest cover in watersheds, aquifer recharge areas, rare ecological areas, and areas of natural scenic vistas; to minimize impervious surface and to protect the quality of water in public water supply watersheds; to promote open, rural areas for the growing of crops, pasturage, horticulture, dairying, floriculture, the raising of poultry and livestock, and for low density residential uses; and otherwise to implement the stated purpose and intent of this Ordinance.

3-C02 Permitted Uses

1. Accessory uses and home occupations as permitted by Article 10.
2. Agriculture, as defined in Article 20.
3. Dwellings, single family detached.
4. Privately-owned dwellings for seasonal occupancy, not designed or used for permanent occupancy, such as summer homes and cottages, hunting and fishing lodges and cabins.
5. Public uses.

3-C03 Special Permit Uses

For specific Group uses, regulations and standards, refer to Article 8.

1. Group 3 - Institutional Uses, limited to:
   A. Churches, chapels, temples, synagogues, and other such places of worship
   B. Churches, chapels, temples, synagogues and other such places of worship with a nursery school or private school of general education
   C. Home child care facilities
2. Group 4 - Community Uses.
3. Group 6 - Outdoor Recreation Uses, limited to:
   A. Camp or recreation grounds
   B. Riding and boarding stables
   C. Skeet and trapshooting ranges
   D. Veterinary hospitals, but only ancillary to kennels, riding or boarding stables
4. Group 7 - Older Structures, limited to:
   A. Restaurants
   B. Summer theatres

5. Group 8 - Temporary Uses, limited to:
   A. Carnival, circus, festival, fair, horse show, dog show, steeplechase, music festival, turkey shoot, sale of Christmas trees or other seasonal commodities and other similar activities
   B. Construction material yards accessory to a construction project
   C. Contractors' offices and equipment sheds to include trailers accessory and adjacent to an active construction project
   D. Subdivision and apartment sales and rental offices
   E. Temporary dwellings or mobile homes
   F. Temporary farmers' markets
   G. Temporary mobile and land based telecommunication testing facility
6. Group 9 - Uses Requiring Special Regulation, limited to:
   A. Home professional offices
   B. Veterinary hospitals
   C. Modification to minimum yard requirements
   D. Accessory dwelling units

3-C04 Special Exception Uses

For specific Category uses, regulations and standards, refer to Article 9.

1. Category 1 - Light Public Utility Uses.
2. Category 2 - Heavy Public Utility Uses, limited to:
   A. Regional sewage treatment and disposal facilities
3. Category 3 - Quasi-Public Uses, limited to:
   A. Alternate uses of public facilities
   B. Churches, chapels, temples, synagogues and other such places of worship with a nursery school or private school of general education
   C. Cultural centers, museums and similar facilities
   D. Dormitories, fraternity/sorority houses, rooming/boarding houses, or other residence halls
   E. Institutions providing housing and general care for the indigent, orphans and the like
   F. Nursery schools
   G. Private clubs
   H. Private schools of general education
   I. Quasi-public parks, playgrounds, athletic fields and related facilities
4. Category 5 - Commercial and Industrial Uses of Special Impact, limited to:
   A. Bed and breakfasts
   B. Golf courses, country clubs
   C. Golf driving ranges
   D. Kennels, animal shelters
   E. Marinas, docks and boating facilities, commercial

F. Offices

G. Plant nurseries

H. Veterinary hospitals, but only ancillary to kennels

3-C05 Use Limitations

1. No sale of goods or products shall be permitted, except as accessory and incidental to a permitted, special permit or special exception use.
2. All uses shall comply with the performance standards set forth in Article 14.
3. Cluster subdivisions may be permitted in accordance with the provisions of Sect. 9-615.

3-C06 Lot Size Requirements

1. Minimum district size for cluster subdivisions: 10 acres
2. Minimum lot area
   A. Conventional subdivision lot: 5 acres
   B. Cluster subdivision lot: 36,000 sq. ft.
3. Minimum lot width
   A. Conventional subdivision lot: 200 feet
   B. Cluster subdivision lot:
      (1) Lot adjacent to a major thoroughfare:
         (a) Interior lot - 200 feet
         (b) Corner lot - 200 feet
      (2) Lot adjacent to a local or collector street:
         (a) Interior lot - No Requirement
         (b) Corner lot - 125 feet

3-C07 Bulk Regulations

1. Maximum building height
   A. Single family dwellings: 35 feet
   B. All other structures: 60 feet
2. Minimum yard requirements
   A. Single family dwellings
      (1) Front yard: 40 feet
      (2) Side yard: 20 feet
      (3) Rear yard: 25 feet
   B. All other structures
      (1) Front yard: Controlled by a 50 dg angle of bulk plane, but not less than 40 feet
      (2) Side yard: Controlled by a 45 dg angle of bulk plane, but not less than 20 feet

(3) Rear yard: Controlled by a 45 dg angle of bulk plane, but not less than 25 feet

3. Maximum floor area ratio:
   A. 0.10 for uses other than residential or public
   B. 0.15 for public uses

3-C08 Maximum Density

One (1) dwelling unit per five (5) acres, or 0.2 dwelling units per acre

3-C09 Open Space

In subdivision approved for cluster development, 50% of the gross area shall be open space

3-C10 Additional Regulations

1. Refer to Article 2, General Regulations, for provisions which may qualify or supplement the regulations presented above.
2. Refer to Article 11 for off-street parking, loading and private street requirements.
3. Refer to Article 12 for regulations on signs.
4. Refer to Article 13 for landscaping and screening requirements.
5. Refer to Article 17 for uses and developments which are subject to site plan provisions.

ZONING ORDINANCE ARTICLE 7
OVERLAY AND COMMERCIAL REVITALIZATION DISTRICT REGULATIONS
PART 8 7-800 WATER SUPPLY PROTECTION OVERLAY DISTRICT

7-801 Purpose and Intent

Water Supply Protection Overlay Districts are created for the purpose of promoting the public health, safety, and welfare through the protection of public water supplies from the danger of water pollution. Regulations within such districts are established to prevent water quality degradation due to pollutant loadings within the watersheds of public water supply reservoirs. This district shall be in addition to and shall overlay all other zoning districts where it is applied, so that any parcel of land lying in such an overlay district shall lie in one or more of the other zoning districts provided for by this Ordinance. The effect is to create a new district which has the characteristics and limitations of the underlying district, together with the characteristics and limitations of the overlying district.

Regulations within such an overlay district are intended to provide a means for specific review and approval of residential, commercial, industrial and other development proposals that may have adverse water quality impacts; to encourage land uses and activities which will be compatible with water quality protection; and to assure that structures and uses within such overlay districts will be developed in a manner that will serve the health, safety and welfare objectives of preserving the environmental integrity of public water supply reservoirs.

7-802 District Boundaries

Water Supply Protection Overlay District boundaries shall be established on the Official Zoning Map, and shall be drawn so as to include lands draining into a water supply reservoir.

7-803 Establishment of Districts

Water Supply Protection Overlay Districts shall be established in the same manner as any other zoning district permitted by this Ordinance, and may be amended in accordance with the provisions of Part 2 of Article 18.

7-804 Administration

1. The Director shall be responsible for reviewing all proposed uses to determine if the property to be developed and/or used is located in the overlay district.
2. If any proposed use is so located, then such use shall be subject, as applicable, to the provisions of Sect. 808 below.

7-805 Permitted Uses

All uses permitted by right in the underlying zoning district(s)

7-806 Special Permit Uses

All uses permitted by special permit in the underlying zoning district(s)

7-807 Special Exception Uses

All uses permitted by special exception in the underlying zoning district(s)

7-808 Use Limitations

In addition to the use limitations presented in the underlying zoning district(s), the following use limitations shall apply:

1. Any subdivision which is subject to the provisions of Chapter 101 of The Code or any use requiring the approval of a site plan in accordance with the provisions of Article 17 shall provide water quality control measures designed to reduce by one-half the projected phosphorus runoff pollution for the proposed use. Such water quality control measures or Best Management Practices (BMPs) shall be reviewed, modified, waived and/or approved by the Director in accordance with the Public Facilities Manual. In no instance shall the requirement for BMPs be modified or waived except where existing site characteristics make the provision impractical or unreasonable on-site and an alternative provision is not or cannot be accommodated off-site, and where it can be established that the modification or waiver will not affect the achievement of the water quality goals for the public water supply watershed as set forth in the adopted comprehensive plan.
2. Any establishment for warehousing, production, processing, assembly, manufacture, compounding, preparation, cleaning, servicing, testing, or repair of materials, goods or products which generates, utilizes, stores, treats, and/or disposes of a hazardous or toxic material or waste, as set forth in Title 40, Code of Federal Regulations, Parts 116.4 and 261.30 et seq., shall submit the following information with any application for a proposed development or use unless deemed unnecessary by the Director:

A. A listing of all toxic and hazardous materials and wastes that will be generated, utilized, stored, treated, and/or disposed of on site;

B. A soils report describing the nature and characteristics of the soils covering the site;

C. A description of surface and groundwater characteristics of the site and the surrounding area within 300 feet of site boundaries;

D. A description of all spill prevention, containment, and leakage control measures proposed by the applicant, for all toxic and hazardous materials and wastes generated, utilized, stored, treated, and/or disposed of on the site.

3. Such information shall be referred to the Department of Public Works and Environmental Services for review in accordance with the provisions of Chapter 67 of The Code and other applicable laws and ordinances. When deemed appropriate, the Director of the Department of Public Works and Environmental Services may furnish a copy of the application and information to the Virginia Department of Environmental Quality and other appropriate agencies.

7-809 Lot Size Requirements

As specified in the underlying zoning district(s)

7-810 Bulk Regulations

As specified in the underlying zoning district(s)

7-811 Open Space

As specified in the underlying zoning district(s)

7-812 Additional Regulations

As specified in the underlying zoning district(s)

LIST OF ACRONYMS AND TERMS
APPENDIX F

2232 REVIEW PROCESS: A public hearing process pursuant to Sect. 15.2-2232 (formerly Sect. 15.1-456) of the Virginia Code that is used to determine if a proposed public facility not shown on the adopted Comprehensive Plan is in substantial accord with the plan. Specifically, this process is used to determine if the general or approximate location, character and extent of a proposed facility is in substantial accord with the Plan.

BENTHICS: Benthics, short for benthic macroinvertebrates, are organisms living in, or on, bottom substrates of aquatic ecosystems.

BG: Billion Gallons.

BMP: Best Management Practice. Stormwater management techniques or land use practices that are determined to be the most effective, practicable means of preventing and/or reducing the amount of pollution generated by nonpoint sources in order to improve water quality.

BZA: Board of Zoning Appeals.

CLUSTER DEVELOPMENT: Residential development in which the lots are clustered on a portion of a site so that significant environmental/historical/cultural resources may be preserved or recreational amenities provided. While smaller lot sizes are permitted in a cluster subdivision to preserve open space, the overall density cannot exceed that permitted in the zoning district if the site were developed as a conventional subdivision.

CBPO: Chesapeake Bay Preservation Ordinance (Chapter 118 of the Fairfax County Code). Regulations that the State has mandated must be adopted to protect the Chesapeake Bay and its tributaries. These regulations must be incorporated into the comprehensive plans, zoning ordinances and subdivision ordinances of the affected localities. Refer to Chesapeake Bay Preservation Act, Va. Code Section 10.1-2100 et seq and VR 173-02-01, Chesapeake Bay Preservation Area Designation and Management Regulations.

CHLOROPHYLL: Green pigment in plants that transforms light energy into chemical energy in photosynthesis.

CWA: Center for Watershed Protection.

CYNOBACTERIA: Bluegreen algae; phylum or organisms that are biochemically bacterial in nature but perform plant photosynthesis.

DEQ: Virginia Department of Environmental Quality.

DO: Dissolved Oxygen. The concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, usually expressed in milligrams per liter, parts per million, or percent of saturation. Adequate concentrations of dissolved oxygen are necessary for the life of fish and other aquatic organisms and the prevention of offensive odors. DO levels are considered the most important and commonly employed measurement of water quality and indicator of a water

body's ability to support desirable aquatic life. Levels above 5 milligrams per liter (mg O_2/L) are considered optimal.

DPWES: Fairfax County Department of Public Works and Environmental Services.

DPZ: Department of Planning and Zoning.

DU/AC: Dwelling Units Per Acre.

EQC: Environmental Quality Corridor. An open space system designed to link and preserve natural resource areas, provide passive recreation, and protect wildlife habitat. The system includes stream valleys, steep slopes and wetlands. For a complete definition of EQCs, refer to the Environmental section of the Policy Plan for Fairfax County contained in Vol. 1 of the Comprehensive Plan.

EQAC: Fairfax County Environmental Quality Advisory Council.

E&SCO: Erosion and Sediment Control Ordinance (Chapter 104 of the Fairfax County Code).

EUTROPHIC: A water body that has high nutrients and high plant growth.

EUTROPHICATION: The process by which lakes and streams are enriched by nutrients (usually phosphorus and nitrogen) which leads to excessive plant growth - algae in the open water, periphyton (*attached* algae) along the shoreline, and macrophytes (the higher plants we often call *weeds*) in the nearshore zone.

FAR: Floor Area Ratio. An expression of the amount of development intensity (typically, non-residential uses) on a specific parcel of land. FAR is determined by dividing the total square footage of gross floor area of buildings on a site by the total square footage of the site itself.

FCPA: Fairfax County Park Authority.

FCWA: Fairfax County Water Authority.

GPS: Global Positioning System.

IMPERVIOUS SURFACE: Any land area covered by buildings or paved with a hard surface such that water cannot seep through the surface into the ground.

INFILL: Development on vacant or underutilized sites within an area which is already mostly developed in an established development pattern or neighborhood.

LID: Low Impact Design. A suite of techniques that attempt to reproduce pre-development hydrology in order to reduce runoff reaching streams and to promote groundwater recharge.

MEP: Maximum Extent Practicable.

MGD: Million Gallons per Day.

MS4: Municipal Separate Storm Sewer System. See VPDES for additional information.

MWAA: Metropolitan Washington Airports Authority.

NPS: Nonpoint Source (Pollution). Unlike pollution from industrial and sewage treatment plants, NPS pollution comes from many diffuse sources and is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, and coastal waters.

NURP: Nationwide Urban Runoff Program.

NUTRIENT LOADING: Discharging of nutrients from the watershed (basin) into a receiving water body (lake, stream, wetland); expressed usually as mass per unit area per unit time (kg/ha/yr or lbs/acre/year.

NVBIA: Northern Virginia Building Industry Association.

NVRC: Northern Virginia Regional Commission, formerly the Northern Virginia Planning District Commission.

NVRPA: Northern Virginia Regional Park Authority.

NVSWCD: Northern Virginia Soil and Water Conservation District.

OWML: Occoquan Watershed Monitoring Lab.

PFM: Public Facilities Manual. A technical text approved by the Board of Supervisors containing guidelines and standards which govern the design and construction of site improvements incorporating applicable federal, State and County Codes, specific standards of the Virginia Department of Transportation and the County's Department of Environmental Management.

PHOSPHORUS: Key nutrient influencing plant growth in lakes. Soluble reactive phosphorus (PO_4^{-3}) is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form.

R-C District: Residential-Conservation District of the Fairfax County Zoning Ordinance.

RMA: Resource Management Area (under the Chesapeake Bay Preservation Ordinance).

RPA: Resource Protection Area (under the Chesapeake Bay Preservation Ordinance).

SEDIMENTATION: The removal, transport, and deposition of detached soil particles by flowing water or wind. Sediment includes decaying algae and weeds and soil and organic matter eroded from the lake's watershed.

SE/SP: Special Exception/Special Permit. Uses, which by their nature, can have an undue impact upon or can be incompatible with other land uses and therefore need a site specific review. After review, such uses may be allowed to locate within given designated zoning districts if appropriate and only under special controls, limitations, and regulations. A special exception is subject to public hearings by the Planning Commission and Board of Supervisors with approval by the Board of Supervisors; a special permit requires a public hearing and

approval by the Board of Zoning Appeals. Unlike proffers, which are voluntary, the Board of Supervisors or BZA may impose reasonable conditions to assure, for example, compatibility and safety. See Article 8, Special Permits and Article 9, Special Exceptions, of the Zoning Ordinance.

SPS: Stream Protection Strategy. Often used in conjunction with the 2001 SPS Baseline Study produced by the Fairfax County Department of Public Works and Environmental Services.

STORMWATER: Precipitation and snowmelt runoff from roadways, parking lots, roof drains that is collected in gutters and drains.

SWPD: Stormwater Planning Division of the Department of Public Works and Environmental Services.

TASK FORCE: New Millennium Occoquan Watershed Task Force.

TMDL: Total Maximum Daily Load. A requirement of the federal Clean Water Act to establish a pollutant budget for streams violating State water quality standards.

TKN: Total Kjeldahl Nitrogen. Sum of ammonia and organic nitrogen forms.

TP: Total Phosphorus.

TSS: Total Suspended Solids.

UOSA: Upper Occoquan Sewage Authority.

VACO: Virginia Association of Counties.

VDOT: Virginia Dept. of Transportation.

VPDES: Virginia Pollutant Discharge Elimination System. Requires the County to obtain a permit from the Virginia Department of Environmental Quality to discharge stormwater from its municipal separate storm sewer system.

VSWCB: Virginia State Water Control Board.

WATERSHED: An area of land where all of the water that is under it or drains off of it goes into the same place.

WRF: Water Reclamation Facility (Upper Occoquan Sewage Authority).

WSPOD: Water Supply Protection Overlay District.